DECLARATION

I declare that this research report is my own, unaided work. It is being submitted for the Degree of Masters of Science in Engineering in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any University.

(Signature of Candidate)

_____day of_____(year)_____

ABSTRACT

A variety of carbonaceous materials are being used for the production of ferrochromium. Reductant materials include carbons such as coal, coke and char. Due to complexity and heterogeneity of carbonaceous reducing materials and a wide range of process requirements, the selection of the most appropriate reducing agent will depend on a number of considerations such as availability of raw material and associated costs, product and process requirements.

Matching the correct carbon reductant for each specific process and product requirements has become a vital function of the ferrochrome industry. This selection process however, has become increasingly difficult. In many cases, the substitution of new a reductant, despite being similar in all relevant chemical specification characteristics to previous material, has resulted in different performance properties relative to that expected.

An investigation prior to the usage of the substituting reductant in the submerged arc furnace was done in order to obtain required performance properties. The investigation concerned the search for a more reliable model in characterizing the reductant according to their reactivity performance, and using the model parameters to choose the appropriate reductant.

The model chosen for this investigation was the Arrhenius model. Sintered chromite ore was reduced with the reductant under investigation in a Thermogravimetric analyzer TGA) at different temperatures. The resultant data was then fitted into the Arrhenius model to obtain the indication of the reactivity of the reductant.

The TGA tests suggest that the Vietnamese anthracite has the highest reactivity since its activation energies are the lowest and requires less energy to induce the reductant reaction. The tests also suggest that the rate controlling mechanism is the diffusion of species to the reactive site since the effective diffusion constant is of the order 10^{-10} to

10^{-11}, which is far less than the chemical rate constant of the order 10^{-6} A generalized rate model developed to describe the reduction of chromite shows that at given particle size and up to a reduction of 40%, the rate of reduction is controlled mainly by interfacial-area chemical reaction, and after which the rate is dominated by diffusion.

ACKNOWLEDGEMENT

I would like to thank Prof. R.H. Eric (my supervisor) for his input in making this investigation a success, and I appreciate his tolerance towards my Chronic medical condition. He found in himself to give me extra time to finish the report, since I had been hospitalized for three months suffering from Schizophrenia.

I would also like to thank the employees of Assmang Chrome Machadodorp (the operators, tappers and their assistants) in utilizing their experience to make this investigation fruitful. I would like to take this opportunity to congratulate them in a job well done. Through this investigation appropriate reductants were selected, and the company managed to save R28.8 million a year of production cost.

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NUMECLATURE

R_T = rate at temperature T (units/sec).

R_{To} = rate at temperature To (unit/sec).

ΔE = activation energy (J/mol).

R = gas constant (J/(mol.K)).

t_i = reaction time (min).

τ = chemical rate control constant (min).

t^* = dimensionless time for a chemical reaction control.

σ_s^2 = ratio of dimensionless time for chemical reaction controlled process to Dimensionless time for diffusion controlled process.

X_i = fraction reduction of sintered chromite ore.

k = chemical reaction rate constant (s^{-1}).

ρ = density (kg/m^3).

F_p = shape factor (3 for spherical particles).

V_p = particle volume (m^3)

A_p = particle cross sectional area (m^2)

b = stoichiometric factor

D_e = effective diffusion coefficient ($m.s^{-1}$)

CHAPTER 1: INTRODUCTION

1.1 Background

Various smelters in South Africa including Assmang Chrome Machadodorp produce high carbon ferrochromium. The production is accomplished by simultaneously smelting chromite ore, reductant (char, coal and coke), fluxes (limestone and serpentine) and silica (quartz) in a submerged arc furnace.

The electric arc and the electrical resistance of the charge generate the heat required for smelting. The heat is most intense at the electrode tip, and this is where most of smelting reactions occur. The smelting reactions involve the reduction of the metal oxides to the metallic state with the formation of a slag. After the initial heating and subsequent reaction of the charge, the reaction products (ferrochromium and slag) drain to the hearth of the furnace. The metal is tapped into a ladle, and cast into a sandpit from where it is broken into smaller pieces for transport purposes.

1.2 Motivation

Coal and coke are the main source of carbon for reduction reactions in the production of ferrochromium. The increasing cost of coke and the fact that suppliers are dwindling, as are the availability of coking coals, leads to consumers in the ferroalloy industry searching for alternative sources of carbon. Such alternatives include char, bituminous coal and anthracite. (Visser, 2000, Hendriktz, Sun, 1997)[1].

A shortage of good quality South African coking coal has led to significant decrease in the production of coke, suitable for utilisation in submerged arc furnaces, at Iscor's coking facilities. The shortage of supply resulted in several price increases which, together with possible discontinuation of required quantities, prompted several investigations into alternative coke suppliers (i.e Zimbabwe and China coke) by Assmang

Chrome Machadodorp. As a result a number of coke suppliers have been changed over the years since 1996.

China nuts coke has been found to complement the operation of the submerged arc furnace in the production of chromium, and have been blended with other reductant in use. In 2003 and 2004, there have been several increase in the cost of China nuts coke, and a decrease in its availability which has led to a higher cost of producing a ton of ferrochromium. This has led Assmang Chrome Machadodorp to look for an alternative cheaper and effective reductant (in terms of chromium recoveries, kg of reductant per ton of metal produced and MW of power consumed per ton of metal produced).

1.3 Objective

Previous investigations done only concentrated on the alternative cokes, in this investigation the aim will be to substitute coke with anthracite. Anthracite is relatively cheaper than coke. Although the alternative anthracite might be of similar chemical analysis when compared to China nuts coke, other physical properties (reactivity, resistivity and strength) considered to be important parameters with regard to desirable burden characteristics during the production of high carbon ferrochromium will differ considerably.

Table1 : Price for different reductants

Reductant	**Price (R/ton)**
China nuts coke	2897.28
Argentine coke	2292.78
Springlake anthracite	442.28
Vietnamese anthracite	745.28

CHAPTER 2: LITERATURE REVIEW

The most important property of a reducing agent used in submerged arc furnace is electrical resistivity of the material. This property depends on the type of material, processing conditions, material sizing, operating temperatures and pressures within the furnace mix. High burden resistivity is necessary for good overall heat distribution. It depends on resistivity of the reducing agent, a stable coke bed at the tip of the electrodes, volume fraction of the reductants, carbon content and particle size.
Higher resistivity is obtained for the burden where the particle size of the reductant is higher than those of other burden components (Dijs, H.M., Smith, DJ)[2]. Electrical resistivity is a structure sensitive parameter that reflects the internal structure. Therefore the electrical resistivity of carbonaceous material can be correlated with fraction of ordered carbon and reactivity (Feng, B., Bhatia, S.K. and Barry, J.C.)[3].

Reactivity of reductants towards reduction of oxides plays an important role in many metal-smelting processes. In general, reactivity decreases with the increase in the degree of graphitisation. In addition, the presence of carbon atoms in the amorphous phase or in aliphatic side chains also leads to an increase in reactivity. The combustion/gasification rate for different reduction materials can therefore be significantly different. As combustion proceeds, reactivity decreases due to loss of volatile matter, enhanced thermal annealing and decreased concentration of active site (Smith, I.W.)[4].

In addition to structural order, physical characteristics such as pore size distribution and surface area, and composition and concentration of ash impurities present in the carbonaceous material also play an important role. Primary electrical contact between the electrode and charge is through a coke bed and electrical properties of this zone are important as it determines the energy and the temperature distribution in the furnace (Olsen, S.E. and Lindstad, T.)[5].

2.1 Characterisation of carbonaceous materials

Carbonaceous materials are complex systems, which are generally heterogeneous in nature. They exhibit a wide variety of physical and chemical properties and chemical properties. While chemical characteristics control the reactivity of the reductant and influence the amount of reduction material used, product quality and energy consumption in the smelting process, physical properties affect the efficiency and productivity of operation to a certain extent. The main carbonaceous materials used in the production of ferrochrome are mainly coal, coke and char.

Coal is composed of mainly carbon, hydrogen, nitrogen, sulphur and inorganic matter. Coal is characterised by its rank, type and grade. Rank characterises the degree of metamorphism of coal and is an important criterion for determining the technological usage of coal. Degree of impurities, maceral composition and calorific value determine the type and grade of coal. Other factors such as texture, porosity, density also affects coal quality. Traditionally, coal selection criteria for ferroalloys production are volatile matter content, ash content, and chemistry and reactivity. Since other reductant material like char and coke are produced from coal their properties will be derived and affected by properties of parent coal material.

Char is formed during pyrolysis, that is the first stage of coal combustion, when heated particles are devolatilised yielding a carbon-rich solid residue. Char properties are affected by chemical and physical properties of the parent coal, temperature and time history.

Coke is produced by heating coal blend in the absence of oxygen to about 1100^{o}C. Quality and properties of coke are affected by the coal rank, fluidity, maceral and mineral matter composition as well as processing conditions. Traditionally, chemistry, particle size, reactivity and strength after reaction are considered as the most important properties of metallurgical coke for blast furnace operations. Electric arc furnace coke, however, requires higher reactivity, lower strength and proper electrical resistivity.

2.2.1 Characterisation technique

A variety of analytical tests have been developed to characterize properties of various carbonaceous materials. Many analytical procedure are available around the world from international standards organisations.

Basic chemical analysis to determine concentrations of moisture, ash, volatile matter, and fixed carbon, supplemented with elemental analysis are generally performed for a basic characterisation of most carbonaceous materials.

Most of mechanical and physical tests used were developed for classifying coals for coke making. These include measurements of specific gravity, free- swelling index, grindability and ash fusion temperature. A reacted coke sample is also used to determine Coke Strength after Reaction (CSR), which is an important property, particularly to blast furnace operations. In the Nippon test a sample is tumbled at 20 rev/min. Tumbling is performed only after extensive reactions with carbon dioxide. CSR is defined as the weight percentage of coke larger than 10 mm in size after 600 revolutions[6].

Reactivity tests play an important role in the assessment of the quality of reduction materials for metallurgical applications. These are based on the gasification of carbonaceous materials in the presence of some oxidizing gas such as carbon dioxide, oxygen, air or steam. There is no universally accepted standard procedure, but reactivity test of coke towards CO_2 developed at Nippon Steel Corporation in Japan in early seventies is widely recognised around the world. In the test, a sample (200g of 20mm particle size) is exposed to CO_2 flow for two hours at 1100^oC. The percentage of mass loss is referred to as reactivity.

In addition to the convectional techniques, characterisation of various carbonaceous materials at an atomic level has gained significance. A number of experimental techniques such as XRD, TEM, SEM, FESEM, and HRTEM supplemented with computer simulations are used nowadays to characterise carbons at an atomic level[7].

Results obtained from these studies have provided a better understanding of the structure of carbonaceous materials, the evolution after heat treatment and oxidation, and interfacial phenomena.

In ferrosilicon production, major gaseous reagent is silicon monoxide. SiO reactivity is the ability of the reducing agent to react with gaseous silicon monoxide at 1650^{o}C to form silicon carbide and carbon monoxide. The SINTEF test[8] is based on the volume of SiO gas required by the reducing agent to attain 10% level of CO in off gases. SiO reactivity generally decreases with coal rank. Coke having isotropic carbon forms proved to be more reactive than cokes with anisotropic carbon forms.

2.2 Reaction mechanism in ferrochrome production

The Chrome charge to the furnace is principally in the form of lump ore and/or pellets. The lump material consists of chromite grains surrounded by solidified host rock. Pellets are made from chromite concentrates that have been agglomerated and pre-treated to form spherical particles. The grain size and microstructure of the chromites are variable from dense rounded grains in the lump to highly fractured acicular grains in the pellets. The particle size ranges of lump ore, pellets and coke are controlled to maximise bed permeability. The chromite forms part of the spinel crystal family, having the general form $(Fe^{2+},Mg^{2+})O.(Al^{3+},Cr^{3+},Fe^{3+})_2O_3$.

As the charge descends and passes through the reaction zones various reactions occur during metal alloy formation. The mechanisms and kinetics of gaseous reduction of solid South African chromites ore have been studied by a number of workers[9]. These appears to be general agreement that in the loose charge zone iron is preferentially reduced from the solid chromite grains by reaction with carbon monoxide gas produced in the lower part of the furnace.

The rate limiting reaction mechanism during the gaseous reduction of dense chromite grains is the ionic diffusion of metal species in the solid spinel phase. Soykan et al[10] proposed that the reduction of chromite occurs by the following sequence:

a) Initially Fe^{3+} and Fe^{2+} at the surface of the chromite particle are reduced to the metallic state. This is followed by immediately by the reduction of Cr^{3+} ions to the divalent state.
b) Cr^{2+} ions diffusing toward the centre of the particle reduce the Fe^{3+} ions in the spinel under the surface of the particle to Fe^{2+} at the interface between the inner and outer cores. Fe^{2+} ions diffuse towards the surface, where they are reduced to metallic iron.
c) After the iron has been completely reduced, Cr^{3+} and any Cr^{2+} that is present are reduced to the metallic state, leaving an iron- and chromium- free spinel, $MgAl_2O_4$.

The partially altered chromite contains a dispersion of fine iron/chromium metal alloy particles. The solid alloy, formed in the early stage of reduction as the charge descends and is heated through the loose charge zone, is low in chromium. As the reaction time and temperature increases, the chromium concentration in the alloy increases. In the later stages of reduction chromium- iron carbides are observed to form[11].

The reaction proceeds topochemically, from the surface of the particle in the case of dense ore or from the surface of individual grains for porous materials. In cross section, this compositional variation within a grain is seen in the form of a core of primary spinel surrounded by continuous shell of secondary spinel of variable composition. The composition and thickness of the shell varies with slag composition, temperature, oxygen potential and reaction time. The Fe-Cr alloy forms initially on the outer surfaces of the grains or along microcracks.

The rate and extent of reduction of the chromite ore is dependent on the chemical composition of the chromite, grain and particle size, porosity, and temperature history in pre-treatment and in the furnace[12]. Chromite ores are not uniform in composition; they

vary widely with source of material particularly in iron concentration. The relationship between the degree of reduction and the chromium reduction therefore depends on the initial composition.

Since the rate limiting reaction mechanism involves solid-state diffusion, diffusion path length is a critical factor determining reaction rate. The ionic flux to the gas/solid interface is inversely proportional to the distance, so that reduction rate is enhanced with decreasing particle and grain size. Even cracks and sub-grains boundaries within the grains enhance the rates of reduction of individual chromite grains. The reduction rates of individual grains in pelletised materials are significantly faster than in lump material because of the smaller grain sizes and the higher porosities of the pellets.

The rate of reduction of the chromite can also be influenced by the composition and proportion of matrix material in the particles, since this material fuses and eventually melts as the charge descends through the furnace. The formation of the liquid phase can have multiple effects. If there is a high proportion of matrix material the porosity of the ore, and consequently the ease of reducing gas penetration into the particle, may be diminished. On the other hand the partially reduced spinel may react with and dissolve in the molten slag phase, decreasing the effective particle size and influencing the temperature at which the grains in the chromite particles become dispersed in the bulk.

CHAPTER 3: METHOD OF STUDY

A common method of test for the reactivity of the reductant (i.e coke or coal) is the exposure of packed bed containing 200g of 20-mm diameter particles to flowing CO_2 at 1100^oC for 2hours. The percentage mass loss (by the Boudouard reaction) is quoted as the "coke reactive index" (CRI).

While it is feasible to predict and measure the CRI values, it is not obvious what values of these indices are desirable for coke used in ferroalloy production. Given the apparent importance of CO generation (in direct reduction reactions), it appears that a high reactivity would be required. On the other hand, the primary electrical contact between the electrode and the charge is through a coke bed directly beneath the electrode tips. Use of a less reactive coke would presumably favour maintenance of such coke bed. Smaller-sized and more-reactive coke is stated to give higher resistivity (A deWaal, IJ Barker)[13]. These counteracting requirements perhaps partially explain the general use of a mixture of reductants in ferroalloy production.

In this investigation an alternative method of testing for reactivity was utilized. This method involves reducing the sintered chromite ore with a chosen reductant in a Thermo-gravimetric analyser (TGA) at different temperatures. In this method reactivity was redefined as the inherent capacity of the reductant to induce the reduction reactions of the ore or the resistance to the reduction process. A model which is close (or compliment) to this definition was found to be the Arrhenius model :

$$R_T = R_{T_o} \exp\left[\frac{-\Delta E}{R}\left(\frac{1}{T} - \frac{1}{T_o}\right)\right] \qquad [1]$$

where R_T and R_{T_o} are the rates (in units/sec) at temperature T and T_o respectively.

ΔE (J/mol) is the activation energy of the reaction which in this case will be the measure of the capacity of the reductant to induce the reduction reactions of the ore (its reactivity).

R (J/(mol.K)) is a gas constant.

Previous investigations done by R.H. Eric[14] on the solid state reduction of chromite ore suggested that the reaction mechanism of the reduction of the ore involves both the chemical reactions and the diffusion of ionic species (Fe^{3+}, Fe^{2+}, Cr^{3+}, Cr^{2+}, Mg^{2+}, Al^{3+} and Ti^{4+}) from and to the reaction sites. This has prompted the use of a mixed rate control model to describe the kinetics of the reduction process of the ore:

$t_i = \tau \mathscr{G}_{\ell}(X_i) + \tau\sigma_s^2 \mathscr{P}_{\ell}(X_i)$, mixed rate control [2]

$\mathscr{G}_{\ell}(X_i) = 1 - (1 - X_i)^{1/3}$, chemical rate control conversion factor [3]

$\mathscr{P}_{\ell}(X_i) = 1 - 3(1 - X_i)^{2/3} + 2(1 - X_i)$, diffusion rate control conversion factor [4]

$$\tau = \frac{t}{t^*} \quad [5]$$

where :

t^* is the dimensionless time for a chemical reaction controlled process

σ_s^2 is the ratio of dimensionless time for a chemical reaction controlled process to dimensionless time for diffusion controlled process.

X_i is the fraction reduction of the sintered ore and was calculated by use of the following equation :

$$X_i = \frac{Mass\ of\ CO\ evolved}{\frac{28.01}{15.999} \times mass\ of\ original\ removable\ oxygen} \quad [6]$$

From equation [2] it follows that :

$k = \frac{\rho F_p V_p}{\tau b A_p}$, chemical reaction rate constant [7]

$D_e = \frac{kV_p}{2\sigma_s^2 A_p}$, effective diffusion coefficient [8]

where :

ρ is the density (kgm^{-3})

F_p is the shape factor (3 for spherical particles)

V_p is the volume (m^3) = $\frac{4}{3}\pi r^3$ (r is the particle radius)

A_p is the cross sectional area (m^2) = $4\pi r^2$ (r is the particle radius)

b is the stoichiometric factor ($\frac{1}{4}$ for the reduction of $FeCr_2O_4$ spinel)

The chemical reaction rate constant (k, in s^{-1}), and the effective diffusion coefficient (D_e, in ms^{-1}) obtained at different temperatures are then fitted into the Arrhenius equation [1].

The reactivity of the reductant will then be obtained from the fit of the data to the Arrhenius equation. In order to access the reliability of the method and the data obtained, tests will be done in the arc furnace whereby three different reductants under investigations will substitute the China nuts coke, or be blended with it.

The results in terms of Chromium recovery, MW power consumption per ton of metal produced, and kg of ore per ton of metal produced will be correlated to the reactivity values. The stability of the smelter furnace operation will also be closely monitored by monitoring the electrode currents, voltages and the furnace mix resistance. For these tests, 20000 metric tons of each reductant under investigation was ordered.

CHAPTER 4: EXPERIMENTAL PROCEDURE

Thermogravimetric analyes (TG) was carried out with a Simultaneous Thermal Analyzer STA 409 PC Luxx as shown in figure1.

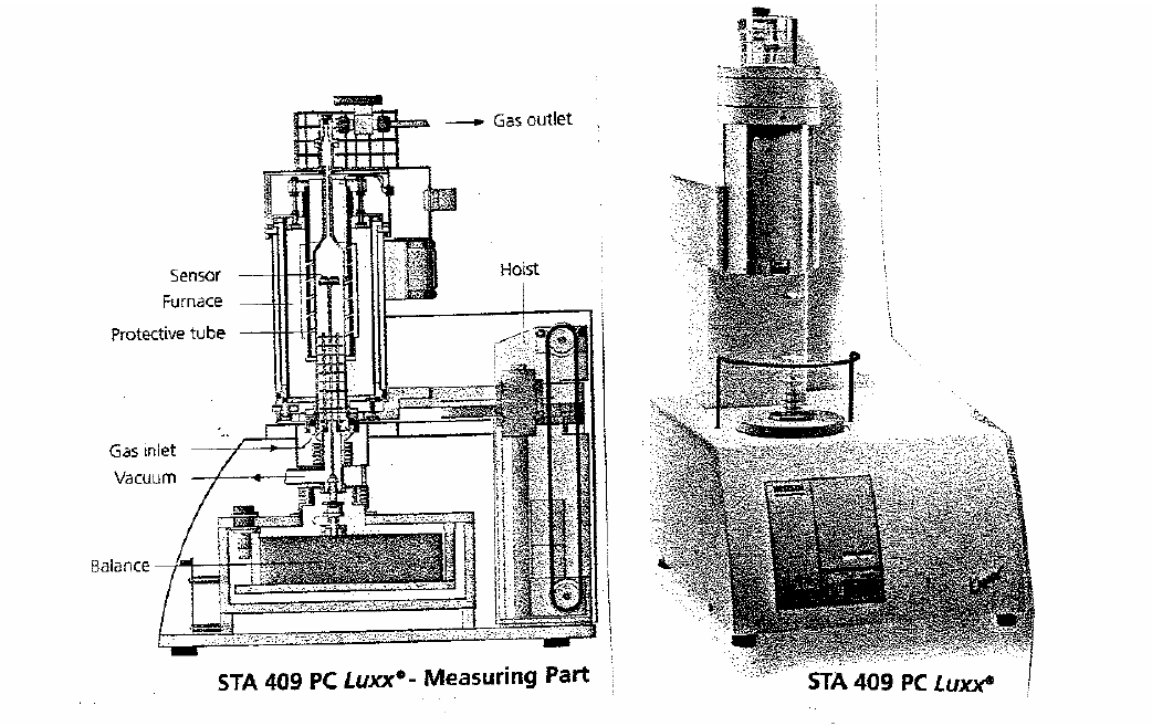


Figure 1: Simultaneous Thermal Analyzer STA 409 PC Luxx.

The reaction mixture consisted of sintered chromite ore (chemical analyses given in table 2), and a reductant under investigation. Reductants under investigation were China nuts coke, Argentine coke, Vietnamese anthracite and Springlake anthracite, and their chemical analyses is given in table 3.

Table 2: Chemical analyses of the sintered chromite ore.

	Cr	Fe total	Fe^{2+}	SiO_2	Al_2O_3	MgO	CaO	Na_2O	K_2O	Zn
%	30.2	19.2	2.2	3.1	12.9	11.0	0.39	0.10	0.12	0.12

Table 3: Chemical analyses of Reductants under investigation.

	Fixed carbon	Ash	Volatiles
China nuts coke	88.85%	9.73%	1.42%
Argentine coke	88.16%	10.48%	1.36%
Vietnamese anthracite	92.86%	4.03%	3.11%
Springlake anthracite	80.1%	10.83%	9.07%

Both the sintered chromite ore and the reductant under investigation were ground and sized to -53 + 75 microns. The reaction mixture was heated in an alumina sample holder from room temperature to the selected reaction temperature at a heating rate of 10^{o}C per minute, and then held for 120 minutes. The selected temperatures were 1190^{o}C, 1240^{o}C, 1290^{o}C, 1340^{o}C and 1390^{o}C. The furnace was flushed continuously with nitrogen gas at a flowrate of 70Nml.min^{-1}. The mass loss caused by the loss of volatile matter from the reductant and the evolution of CO gas by the reduction reactions was measured continuously by the Simultaneous Thermal analyzer.

Literature suggest that the reduction of chromite ore starts around 900^{o}C (M. Honkaniem, H. Krogerus, J. Daavittila and P. Oikarinen)[15]. The mass loss due to volatiles is calculated from the observed mass loss measured from room temperature till 900^{o}C, and the mass loss due to CO evolution is calculated from the observed mass loss from 900^{o}C till the specified reaction time (i.e. after 120 minutes, at the selected reaction temperature). The percentage reduction at a given time and selected reaction temperature was then calculated by use of equation [6].

CHAPTER 5: EXPERIMENTAL RESULTS

The mass of removable oxygen in equation [6] is obtained as follows:
The sintered chromite ore contain 30.2% Cr, 17.0% Fe^{3+}, and 2.2% Fe^{2+}.
If we consider 100mg of sintered chromite ore, then 30.2mg is Cr, 17.0mg is Fe^{3+}, and 2.2mg is Fe^{2+}.

By stoichiometry: 55.845g Fe^{2+} is contained in 71.844g FeO
Then 2.2mg Fe^{2+} is contained in 2.8303mg FeO
Hence oxygen in 2.8303mg FeO = 0.6303mg

By stoichiometry: 111.69g Fe^{3+} is contained in 159.687g Fe_2O_3
Then 17.0mg Fe^{3+} is contained in 24.305mg Fe_2O_3
Hence oxygen in 24.305mg Fe_2O_3 = 7.305mg

By stoichiometry: 103.992g Cr is contained in 151.989g Cr_2O_3
Then 30.2mg Cr is contained in 44.139mg Cr_2O_3
Hence oxygen in 44.139mg Cr_2O_3 = 13.939mg

Total mass of removable oxygen = 21.8743mg in 100mg of sintered chromite ore sample.

5.1 Determination of the reactivity of Argentine coke.

199.5 mg of sintered chromite ore and 58.8mg of Argentine coke was used. The mixture contains 20% excess carbon required to react with Cr_2O_3 and FeO and Fe_2O_3 in the chromite ore. The reaction mixture was heated in an alumina sample holder from room temperature to the selected reaction temperature at a heating rate of 10^oC per minute, and then held for 120 minutes.

The selected temperatures were 1190°C, 1240°C, 1290°C, 1340°C and 1390°C. Literature suggest that the reduction of chromite ore starts around 900°C (M. Honkaniem, H. Krogerus, J. Daavittila and P. Oikarinen)[15]. Hence to compute the fraction reduction of the sintered ore (X_i) at the selected temperature, a correction should be made to take into account the reduction that occurs from 900°C to the selected temperature. Correlation of the fraction reduction with temperature has been found to be in the form (Y. Yang, Y. Xiao and M.A. Reuter)[16]:

$$X_{corr} = a(T-900) + b(T-900)^2 + c(T-900)^3 \quad [9]$$

where T is the temperature in °C. The data obtained in appendix 1 was fitted into equation [9] (as shown in graph 1) using the curve fitting technique as follows:

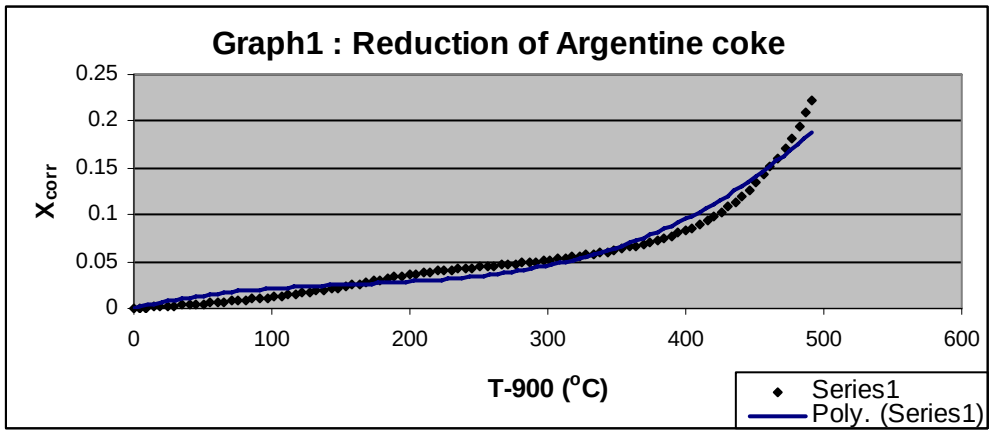
$$\sum Y = a\sum X + b\sum X^2 + c\sum X^3 \quad [10]$$

$$\sum XY = a\sum X^2 + b\sum X^3 + c\sum X^4 \quad [11]$$

$$\sum X^2Y = a\sum X^3 + b\sum X^4 + c\sum X^5 \quad [12]$$

$$\sum X^3Y = a\sum X^4 + b\sum X^5 + c\sum X^6 \quad [13]$$

$$R^2 = \frac{\sum\left(Y_{fit} - \bar{Y}\right)^2}{\sum\left(Y - \bar{Y}\right)^2} \quad [14]$$



Graph 1: Reduction of sintered chromite ore using Argentine coke.

The fit yields:

$$X_{corr} = 0.000358088(T-900) - 1.849494\times10^{-6}(T-900)^2 + 3.88085\times10^{-9}(T-900)^3$$

$$R^2 = 0.967506$$

Table 4: Values of X_{corr} at different temperatures.

T (^{o}C)	X_{corr}
1190	0.042953
1240	0.060482
1290	0.088555
1340	0.130083
1390	0.187978

5.1.1 Determination of τ and σ_s^2 at 1190^{o}C

X_{corr} at 1190^{o}C = 0.042953

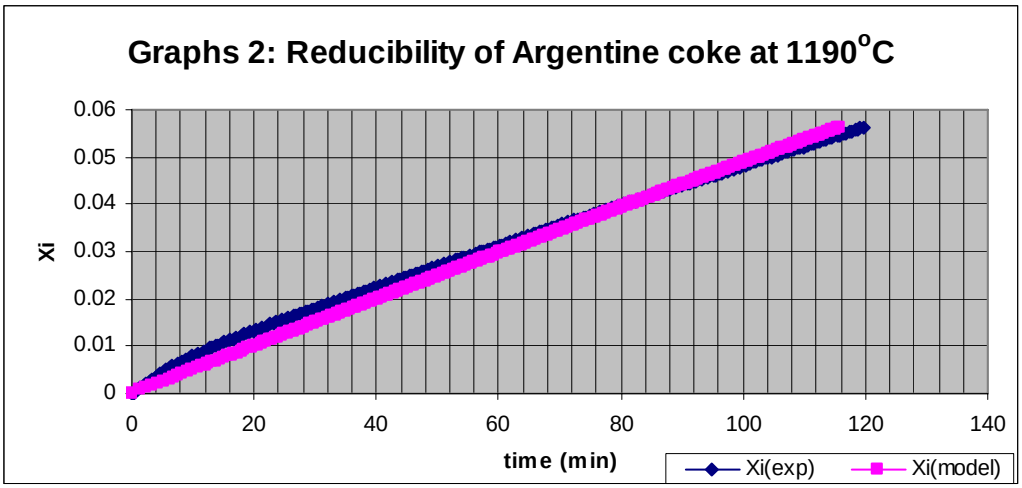
X_i (at 1190^{o}C) = X_i (from 900^{o}C) – 0.042953

The generated data in appendix 2 was fitted into equation [2] (as shown in graph 2) using the sum of least squares as follows:

$$S^2 = \sum_{i=i}^{n}(error)_i^2 = \sum_{i=1}^{n}\left[a_1\mathscr{S}(X_i) + a_2\mathscr{P}(X_i) - t_i\right]^2 \qquad [15]$$

where $a_1 = \tau$

and $a_2 = \tau\sigma_s^2$



Graph 2 : Reduction of sintered chromite ore at 1190°C.

The fit yield:

$\tau = 5945$

$\sigma_s^2 = 0.35122$

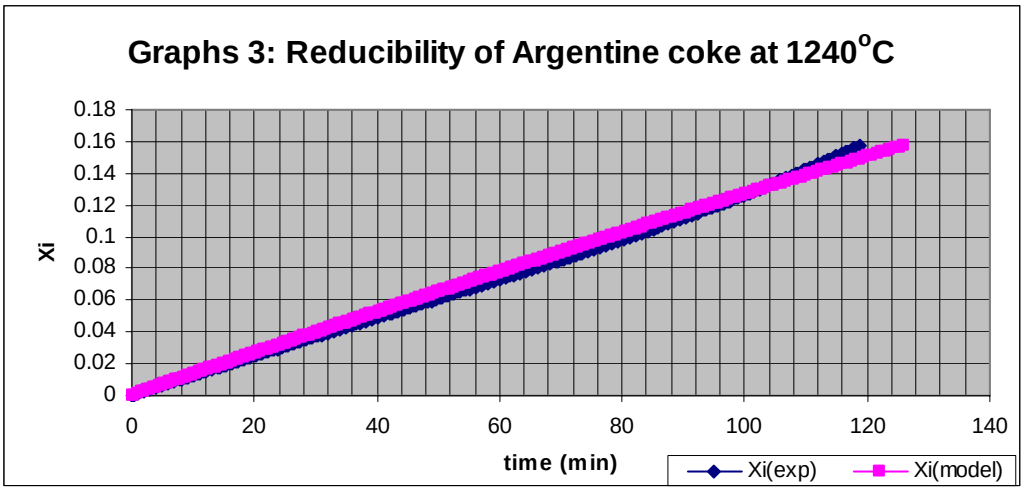
and $S^2 = 3928.46$

5.1.2 Determination of τ and σ_s^2 at 1240°C

X_{corr} at 1240°C = 0.060482

X_i (at 1240°C) = X_i (from 900°C) – 0.060482

The generated data in appendix 3 was fitted into equation [2] (as shown in graph 3) using the sum of least squares through equation [15].



Graph 3 : Reduction of sintered chromite ore at 1240°C.

The fit yields:

$\tau = 2239.3$

$\sigma_s^2 = 0.090609$

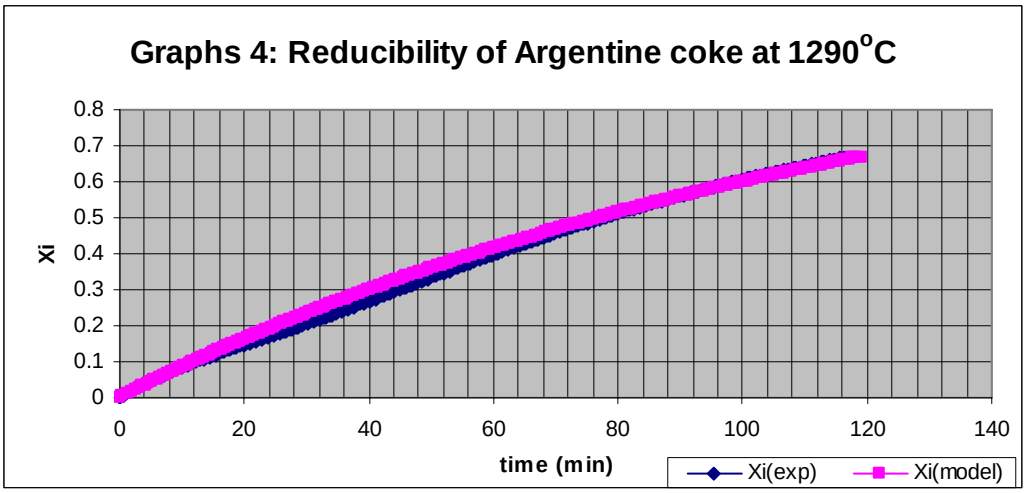
and $S^2 = 1879.14$

5.1.3 Determination of τ and σ_s^2 at 1290°C

X_{corr} at 1290°C = 0.088555

X_i (at 1290°C) = X_i (from 900°C) – 0.088555

The generated data in appendix 4 was fitted into equation [2] (as shown in graph 4) using the sum of least squares through equation [15].



Graph 4 : Reduction of sintered chromite ore at 1290°C.

The fit yields:

$\tau = 337.4$

$\sigma_s^2 = 0.195554$

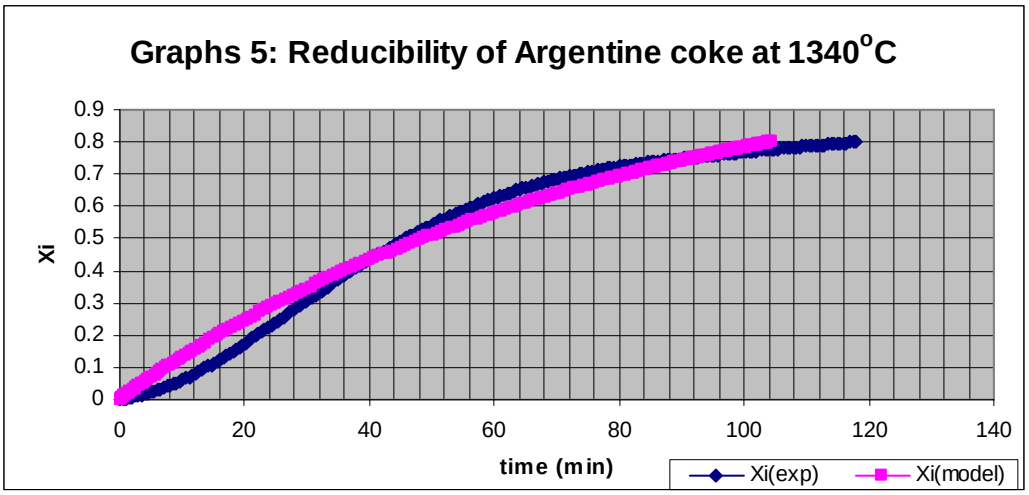
and $S^2 = 1723.49$

5.1.4 Determination of τ and σ_s^2 at 1340°C

X_{corr} at 1340°C = 0.130083

X_i (at 1340°C) = X_i (from 900°C) – 0.130083

The generated data in appendix 5 was fitted into equation [2] (as shown in graph 5) using the sum of least squares through equation [15].



Graph 5 : Reduction of sintered chromite ore at 1340°C.

The fit yields:

$\tau = 212.79$

$\sigma_s^2 = 0.202359$

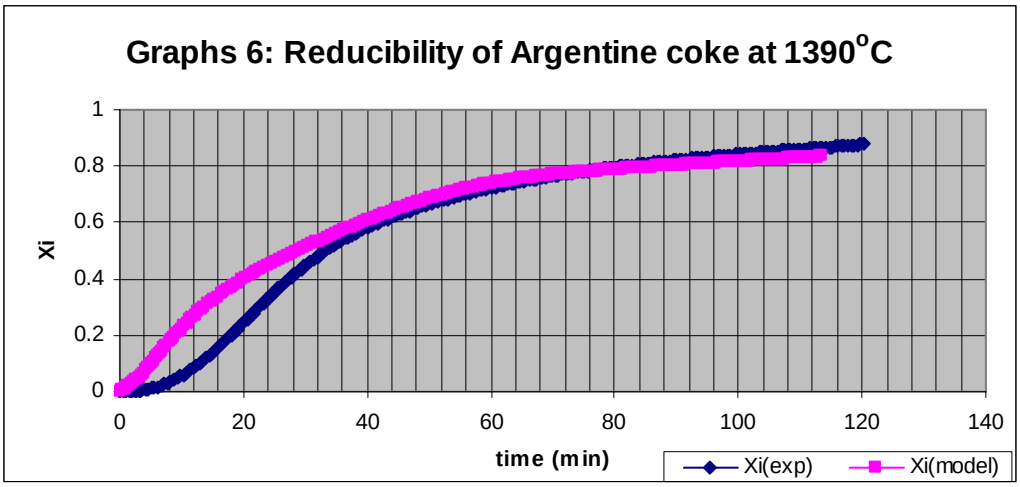
and $S^2 = 8465.11$

5.1.5 Determination of τ and σ_s^2 at 1390°C

X_{corr} at 1390°C = 0.187978

X_i (at 1390°C) = X_i (from 900°C) – 0.187978

The generated data in appendix 6 was fitted into equation [2] (as shown in graph 6) using the sum of least squares through equation [15].



Graph 6 : Reduction of sintered chromite ore at 1390°C.

The fit yields:

$\tau = 188.12$

$\sigma_s^2 = 0.099405$

and $S^2 = 15528.8$

5.1.6 Determination of ΔE (for chemical reaction) and ΔE (for diffusion) .

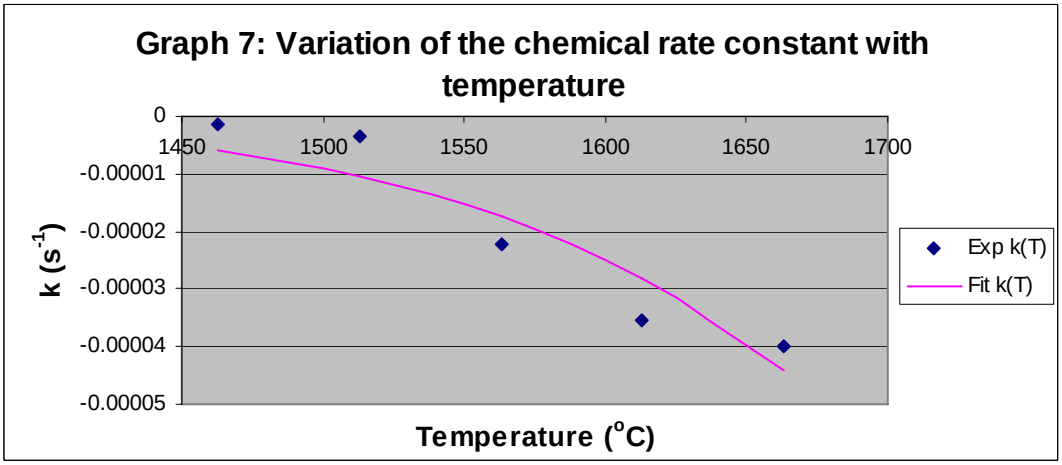
From equation [7] and equation [8], the values of the chemical reaction rate constant (k , in s^{-1}), and the effective diffusion coefficient (D_e , in ms^{-1}) are obtained at different temperatures and are as follows:

Table 5: Values of k and D_e at different temperatures

Temp (^{o}C)	τ (min)	τ (s)	σ_s^2	k (s^{-1})	D_e ($m.s^{-1}$)
1190	5945	356700	0.35122	1.26308×10^{-6}	1.88948×10^{-11}
1240	2239.3	134358	0.090609	3.35329×10^{-6}	1.94442×10^{-10}
1290	337.4	20244	0.195554	2.22555×10^{-5}	5.97945×10^{-10}
1340	212.79	12767.4	0.202359	3.52884×10^{-5}	9.16219×10^{-10}
1390	188.12	11287.2	0.099405	3.99161×10^{-5}	2.10974×10^{-9}

The values of k at different temperatures were fitted into Equation [1] (as shown in graph 7) using the sum of least squares as follows:

$$S^2 = \sum_{i=1}^{n}\left(k_o \exp\left[\frac{-\Delta E}{R}\left\{\frac{1}{T_i}-\frac{1}{T_o}\right\}\right] - k_i \right)^2 \qquad [16]$$



Graph 7: Variation of the chemical reaction rate constant (k, in s^{-1}) with temperature.

The fit yields:

$\Delta E = 201813.4$ J/mol (for chemical reaction)

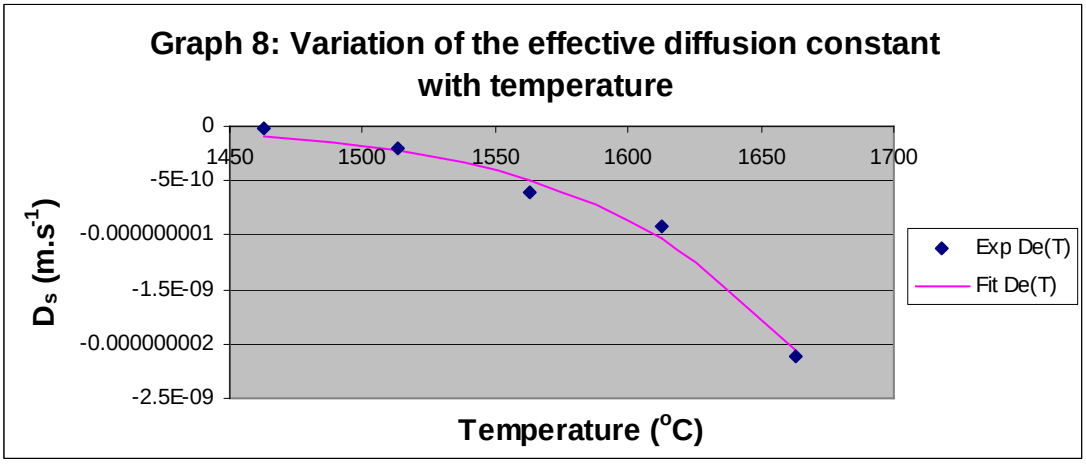
$k_o = 6.0097\times10^{-6}$ s^{-1}

$T_0 = 1463.132$ ^{o}K

and $S^2 = 1.65825\times10^{-10}$

The values of D_e at different temperatures were also fitted into Equation [1] (as shown in graph 8) using the sum of least squares as follows:

$$S^2 = \sum_{i=1}^{n} \left(D_o \exp\left[\frac{-\Delta E}{R} \left\{ \frac{1}{T_i} - \frac{1}{T_o} \right\} \right] - D_{i_i} \right)^2 \qquad [17]$$



Graph 8: Variation of the effective diffusion coefficient (D_e , in ms^{-1}) with temperature.

The fit yields:

$\Delta E = 306809.4$ J/mol (for diffusion)

$D_e = 9.9634 \times 10^{-11}$ m.s^{-1}

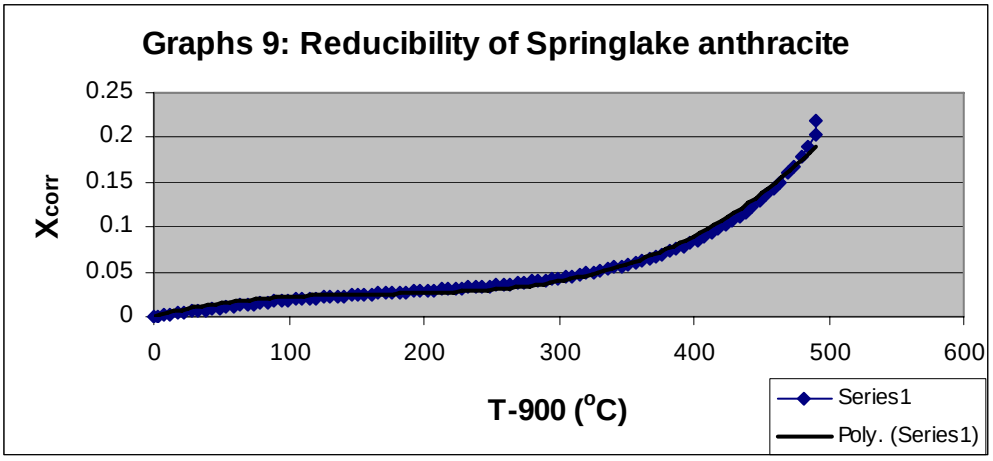
$T_0 = 1463.132$ ^{o}K

and $S^2 = 3.4227 \times 10^{-20}$

5.2 Determination of the reactivity of Springlake anthracite.

200.1 mg of sintered chromite ore and 59.1mg of Springlake anthracite was used. The mixture contains 20% excess carbon required to react with Cr_2O_3 and FeO and Fe_2O_3 in the chromite ore . The reaction mixture was heated in an alumina sample holder from room temperature to the selected reaction temperature at a heating rate of 10^{o}C per

minute, and then held for 120 minutes. The selected temperatures were 1190°C, 1240°C, 1290°C, 1340°C and 1390°C. Determination of the fraction reduction with temperature to account for the reduction occurred from 900°C to the selected temperature is as mentioned in section 5.1.



Graph 9: Reduction of sintered chromite ore using Springlake anthracite.

The fit yields:

$$X_{corr} = 0.00040649641(T-900) - 2.2910705\times10^{-6}(T-900)^2 + 4.587641\times10^{-9}(T-900)^3$$

$R^2 = 0.98866$

Table 6: Values of X_{corr} at different temperatures.

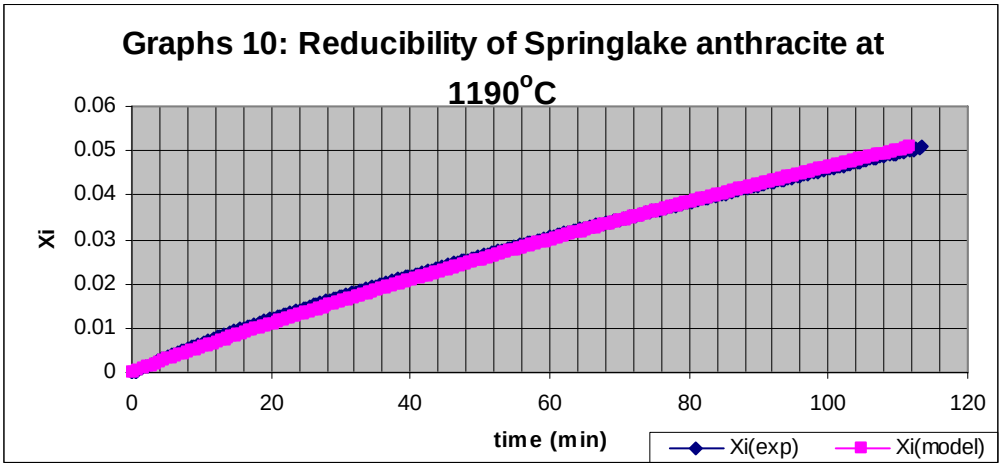
T (°C)	X_{corr}
1190	0.037093
1240	0.053674
1290	0.082196
1340	0.126101
1390	0.188829

5.2.1 Determination of τ and σ_s^2 at 1190°C

X_{corr} at 1190°C = 0.037093

X_i (at 1190°C) = X_i (from 900°C) – 0.037093

The generated data in appendix 8 was fitted into equation [2] (as shown in graph 10) using the sum of least squares shown in equation [15].



Graph 10 : Reduction of sintered chromite ore at 1190°C.

The fit yields:

$\tau = 5238$

$\sigma_s^2 = 4.694922$

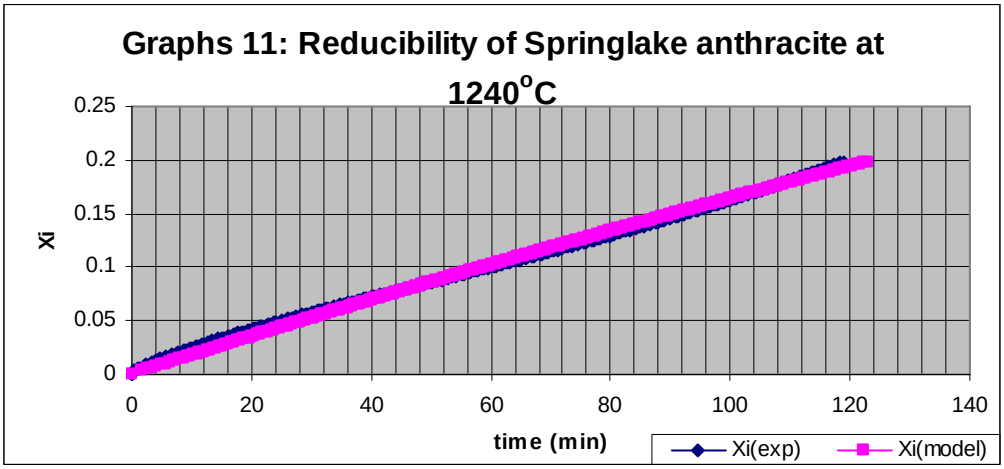
and $S^2 = 642.108$

5.2.2 Determination of τ and σ_s^2 at 1240°C

X_{corr} at 1240°C = 0.053674

X_i (at 1240°C) = X_i (from 900°C) – 0.053674

The generated data in appendix 9 was fitted into equation [2] (as shown in graph 11) through equation [15].



Graph 11 : Reduction of sintered chromite ore at 1240°C.

The fit yields:

$\tau = 1672$

$\sigma_s^2 = 0.187081$

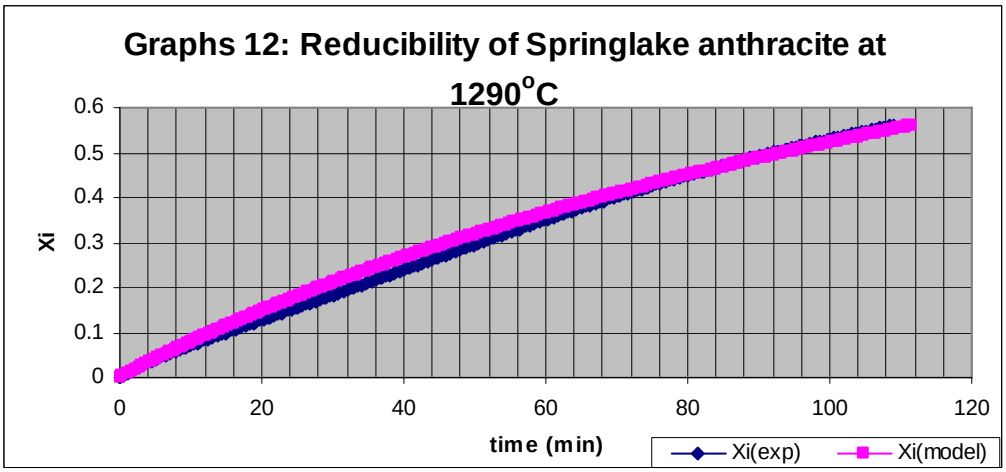
and $S^2 = 1383.482$

5.2.3 Determination of τ and σ_s^2 at 1290°C

X_{corr} at 1290°C = 0.082196

X_i (at 1290°C) = X_i (from 900°C) – 0.082196

The generated data in appendix 10 was fitted into equation [2] (as shown in graph 12) using the sum of least squares of equation [15].



Graph 12 : Reduction of sintered chromite ore at 1290°C.

The fit yields:

$\tau = 357.7$

$\sigma_s^2 = 0.502656$

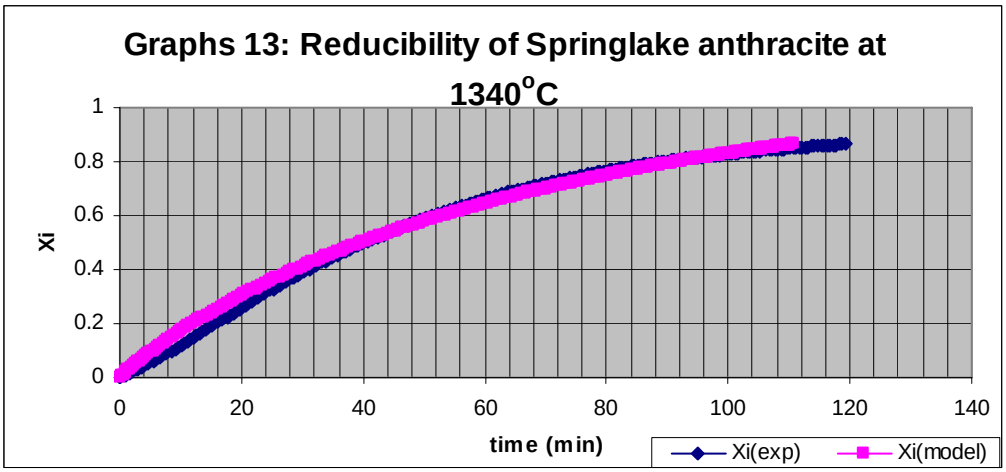
and $S^2 = 1829.85970$

5.2.4 Determination of τ and σ_s^2 at 1340°C

X_{corr} at 1340°C = 0.126101

X_i (at 1340°C) = X_i (from 900°C) – 0.126101

The generated data in appendix 11 was fitted into equation [2] (as shown in graph 13) using the sum of least squares of equation [15].



Graph 13 : Reduction of sintered chromite ore at 1340°C.

The fit yields:

$\tau = 152.5$

$\sigma_s^2 = 0.499672$

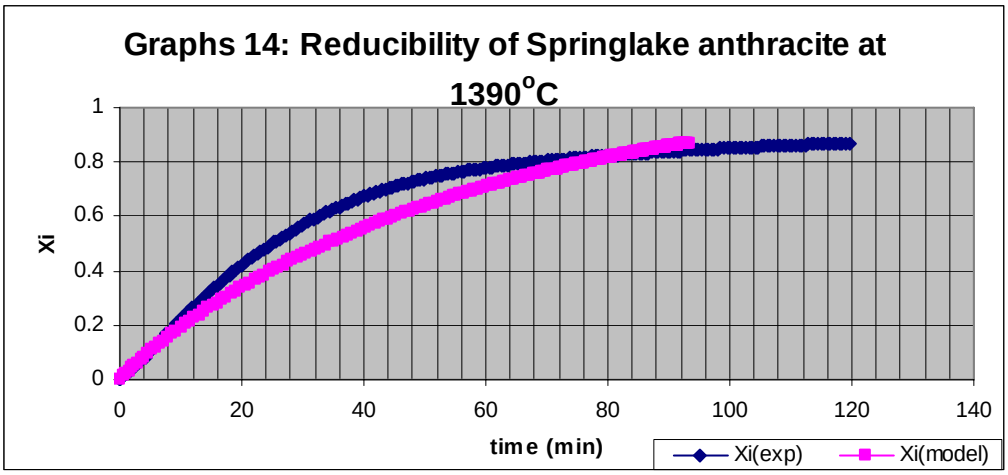
and $S^2 = 2305.0092$

5.2.5 Determination of τ and σ_s^2 at 1390°C

X_{corr} at 1390°C = 0.188829

X_i (at 1390°C) = X_i (from 900°C) – 0.188829

The generated data in appendix 12 was fitted into equation [2] (as shown in graph 14) using the sum of least squares of equation [15].



Graph 14 : Reduction of sintered chromite ore at 1390°C.

The fit yields:

$\tau = 137.00$

$\sigma_s^2 = 0.382482$

and $S^2 = 32288.81$

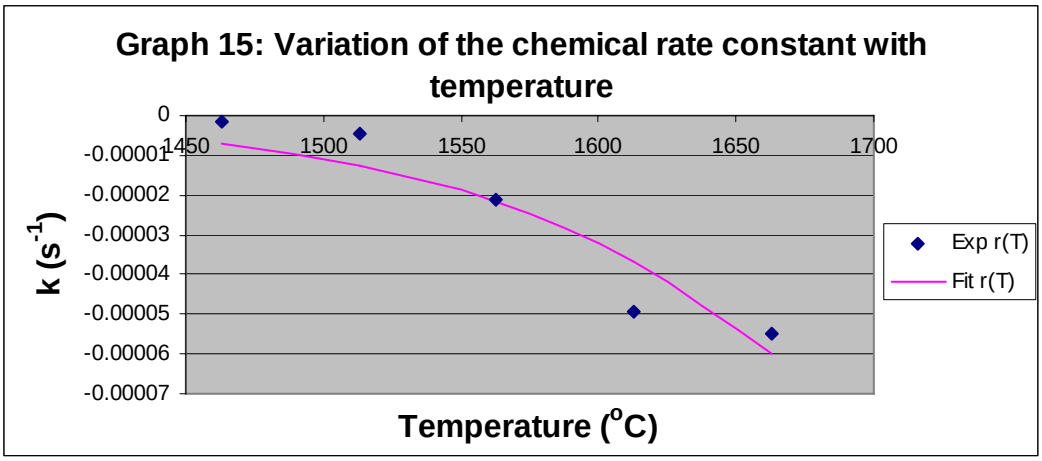
5.2.6 Determination of ΔE (for chemical reaction) and ΔE (for diffusion) .

From equation [7] and equation [8], the values of the chemical reaction rate constant (k , in s^{-1}), and the effective diffusion coefficient (D_e , in ms^{-1}) are obtained at different temperatures and are as follows:

Table 7: Values of k and D_e at different temperatures

Temp (^{o}C)	τ (min)	τ (s)	σ_s^2	k (s^{-1})	D_e ($m.s^{-1}$)
1190	5238	314280	4.694922	1.43357×10^{-6}	1.60428×10^{-12}
1240	1672	100320	0.187081	4.49104×10^{-6}	1.26127×10^{-10}
1290	357.7	21462	0.502656	2.09925×10^{-5}	2.19424×10^{-10}
1340	152.5	9150	0.499672	4.92395×10^{-5}	5.17748×10^{-10}
1390	137.00	8220	0.382482	5.48103×10^{-5}	7.52907×10^{-9}

The values of k at different temperatures were fitted into Equation [1] (as shown in graph 15) using the sum of least squares of equation [15]



Graph 15: Variation of the chemical reaction rate constant (k, in s^{-1}) with temperature.

The fit yields:

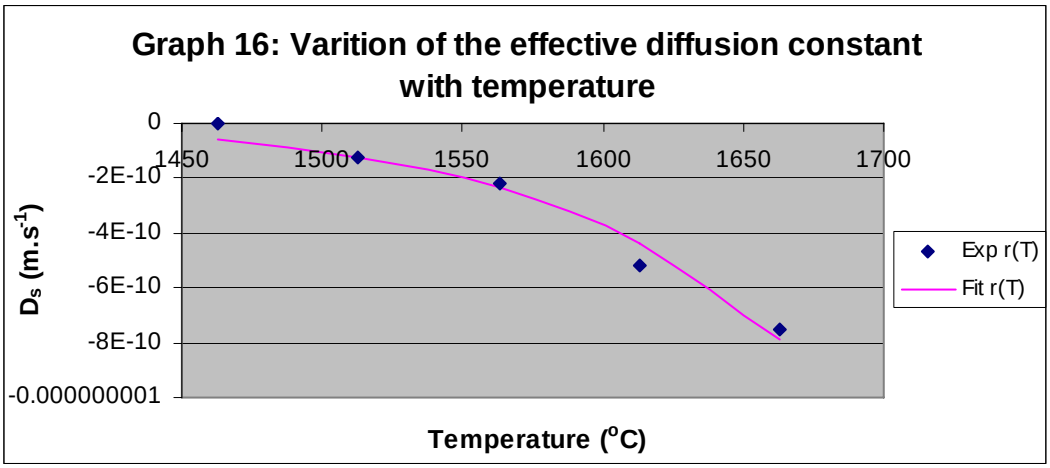
$\Delta E = 217507.6$ J/mol (for chemical reaction)

$k_o = 6.97581\times10^{-6}$ s^{-1}

$T_0 = 1463.132$ ^{o}K

and $S^2 = 2.78189\times10^{-10}$

Similarly the values of D_e at different temperatures were also fitted into Equation [1] (as shown in graph 16) using the sum of least squares of equation [17].



Graph 16: Variation of the effective diffusion coefficient (D_e , in ms^{-1}) with temperature.

The fit yields:

$\Delta E = 260252.7$ J/mol (for diffusion)

$D_e = 6.02099 \times 10^{-11}$ m.s^{-1}

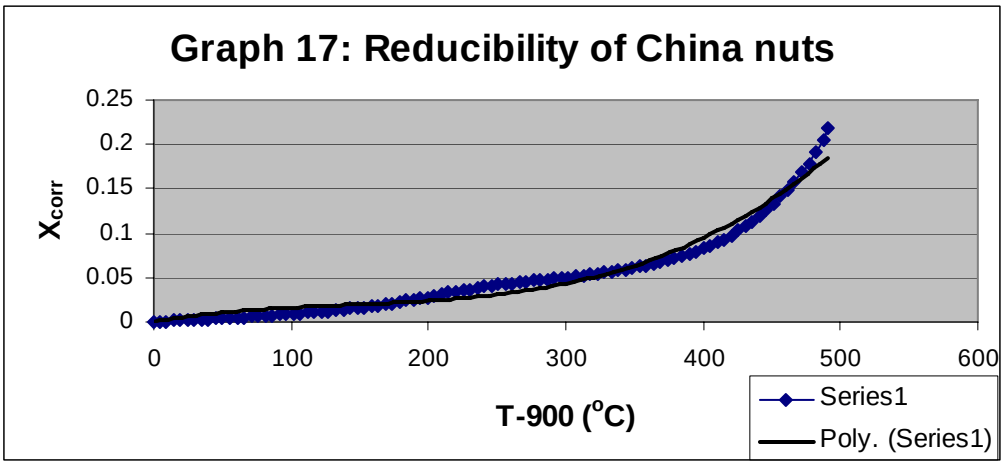
$T_0 = 1463.132$ ^{o}K

and $S^2 = 1.10551 \times 10^{-20}$

5.3 Determination of the reactivity of China nuts coke.

200.3 mg of sintered chromite ore and 50.6mg of China nuts coke was used. The mixture contains 20% excess carbon required to react with Cr_2O_3 and FeO and Fe_2O_3 in the chromite ore. The reaction mixture was heated in an alumina sample holder from room temperature to the selected reaction temperature at a heating rate of 10^{o}C per minute, and then held for 120 minutes. The selected temperatures were 1190^{o}C, 1240^{o}C, 1290^{o}C, 1340^{o}C and 1390^{o}C. Determination of the fraction reduction with temperature to account

for the reduction occurred from 900°C to the selected temperature is as mentioned in section 5.1.



Graph 17: Reduction of sintered chromite ore using China nuts coke.

The fit yields:

$$X_{corr} = 0.00027233225(T-900) - 1.438868029\times10^{-6}(T-900)^2 + 3.371531\times10^{-9}(T-900)^3$$

$R^2 = 0.971144$

Table 8: Values of X_{corr} at different temperatures.

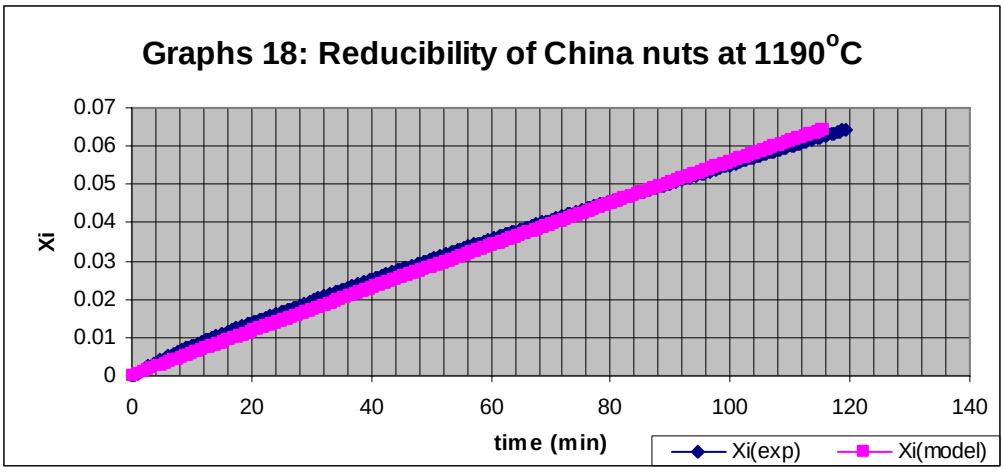
T (°C)	X_{corr}
1190	0.040196
1240	0.058774
1290	0.087354
1340	0.128462
1390	0.184628

5.3.1 Determination of τ and σ_s^2 at 1190°C

X_{corr} at 1190°C = 0.040196

X_i (at 1190°C) = X_i (from 900°C) – 0.040196

The generated data in appendix 14 was fitted into equation [2] (as shown in graph 18) through equation [15].



Graph 18 : Reduction of sintered chromite ore at 1190°C.

The fit yields:

$\tau = 5205$

$\sigma_s^2 = 0.2244$

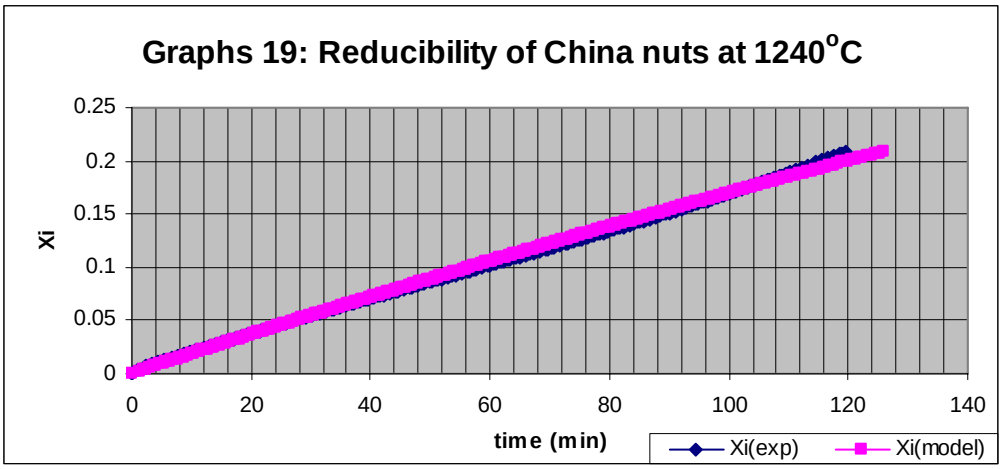
and $S^2 = 2193.9534$

5.3.2 Determination of τ and σ_s^2 at 1240°C

X_{corr} at 1240°C = 0.058774

X_i (at 1240°C) = X_i (from 900°C) – 0.058774

The generated data in appendix 15 was fitted into equation [2] (as shown in graph 19) using the sum of least squares of equation [15].



Graph 19 : Reduction of sintered chromite ore at 1240°C.

The fit yields:

$\tau = 1616.5$

$\sigma_s^2 = 0.178781$

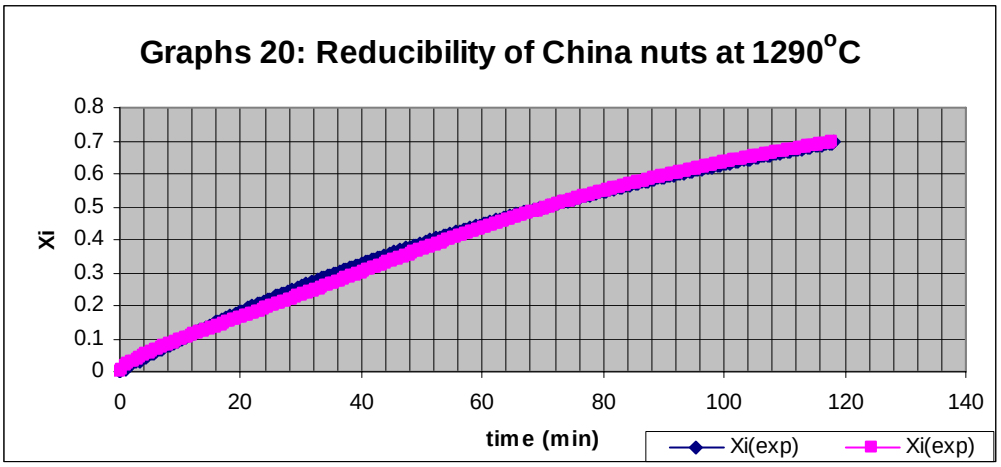
and $S^2 = 935.089$

5.3.3 Determination of τ and σ_s^2 at 1290°C

X_{corr} at 1290°C = 0.087354

X_i (at 1290°C) = X_i (from 900°C) – 0.087354

The generated data in appendix 16 was fitted into equation [2] (as shown in graph 20) using the sum of least squares of equation [15].



Graph 20 : Reduction of sintered chromite ore at 1290°C.

The fit yields:

$\tau = 291.9$

$\sigma_s^2 = 0.316204$

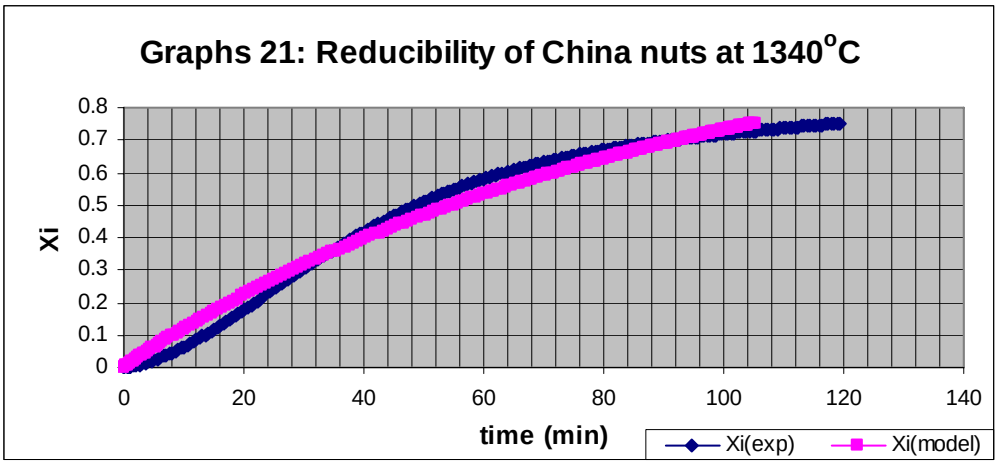
and $S^2 = 1147.0396$

5.3.4 Determination of τ and σ_s^2 at 1340°C

X_{corr} at 1340°C = 0.128462

X_i (at 1340°C) = X_i (from 900°C) – 0.128462

The generated data in appendix 17 was fitted into equation [2] (as shown in graph 21) through equation [15].



Graph 21 : Reduction of sintered chromite ore at 1340°C.

The fit yields:

$\tau = 234.7$

$\sigma_s^2 = 0.246698$

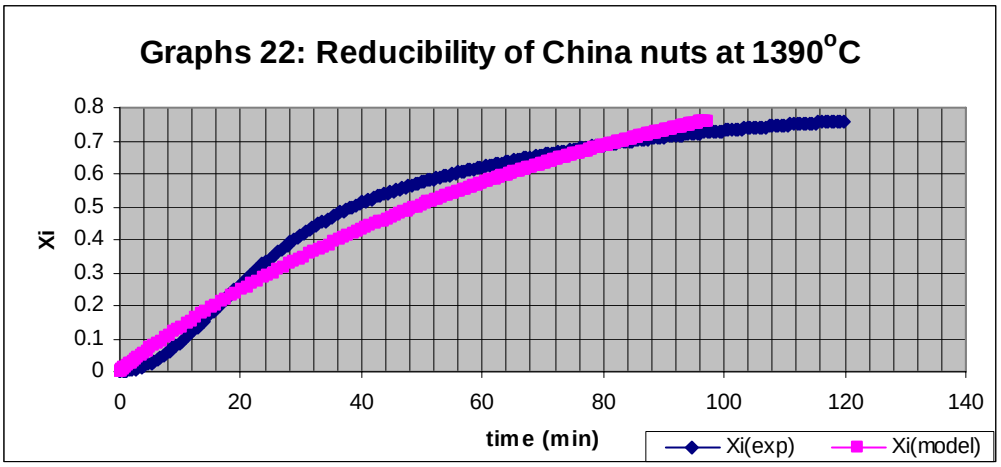
and $S^2 = 8360.67993$

5.3.5 Determination of τ and σ_s^2 at 1390°C

X_{corr} at 1390°C = 0.184628

X_i (at 1390°C) = X_i (from 900°C) – 0.184628

The generated data in appendix 18 was fitted into equation [2] (as shown in graph 22) using the sum of least squares of equation [15].



Graph 22 : Reduction of sintered chromite ore at 1390°C.

The fit yields:

$\tau = 210$

$\sigma_s^2 = 0.261905$

and $S^2 = 19569.2$

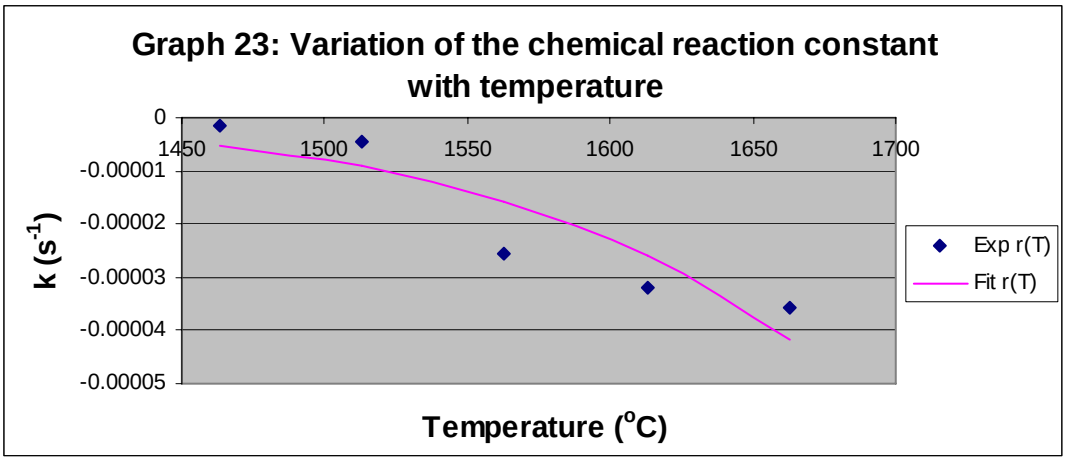
5.3.6 Determination of ΔE (for chemical reaction) and ΔE (for diffusion) .

From equation [7] and equation [8], the values of the chemical reaction rate constant (k, in s^{-1}), and the effective diffusion coefficient (D_e, in ms^{-1}) are obtained at different temperatures and are as follows:

Table 9: Values of k and D_e at different temperatures

Temp (^{o}C)	τ (min)	τ (s)	σ_s^2	k (s^{-1})	D_e ($m.s^{-1}$)
1190	5205	312300	0.2244	1.44265×10^{-6}	3.37777×10^{-11}
1240	1616.5	96990	0.178781	4.64523×10^{-6}	1.36514×10^{-10}
1290	291.9	17514	0.316204	2.57246×10^{-5}	4.27437×10^{-10}
1340	234.7	14082	0.246698	3.19941×10^{-5}	6.81388×10^{-10}
1390	210	12600	0.261905	3.57572×10^{-5}	7.17315×10^{-10}

The values of k at different temperatures were fitted into Equation [1] (as shown in graph 23) using the sum of least squares of equation [16].



Graph 23: Variation of the chemical reaction rate constant (k, in s^{-1}) with temperature.

The fit yields:

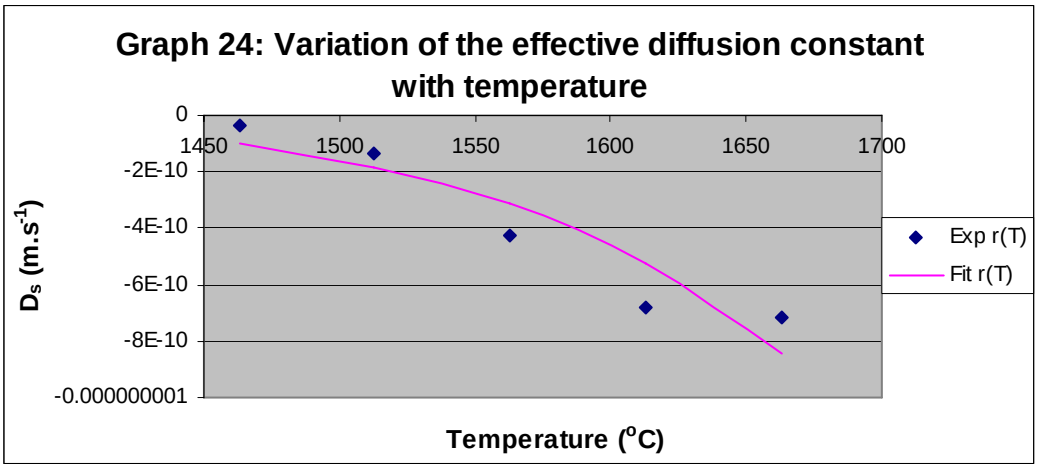
$\Delta E = 212435.6$ J/mol (for chemical reaction)

$k_o = 5.12863\times10^{-6}$ s^{-1}

$T_0 = 1463.132$ ^{o}K

and $S^2 = 2.0804\times10^{-10}$

The values of D_e at different temperatures were also fitted into Equation [1] (as shown in graph 24) using the sum of least squares of equation [17].



Graph 24: Variation of the effective diffusion coefficient (D_e , in ms^{-1}) with temperature.

The fit yields:

$\Delta E = 213134.3$ J/mol (for diffusion)

$D_e = 1.02363 \times 10^{-10}$ m.s^{-1}

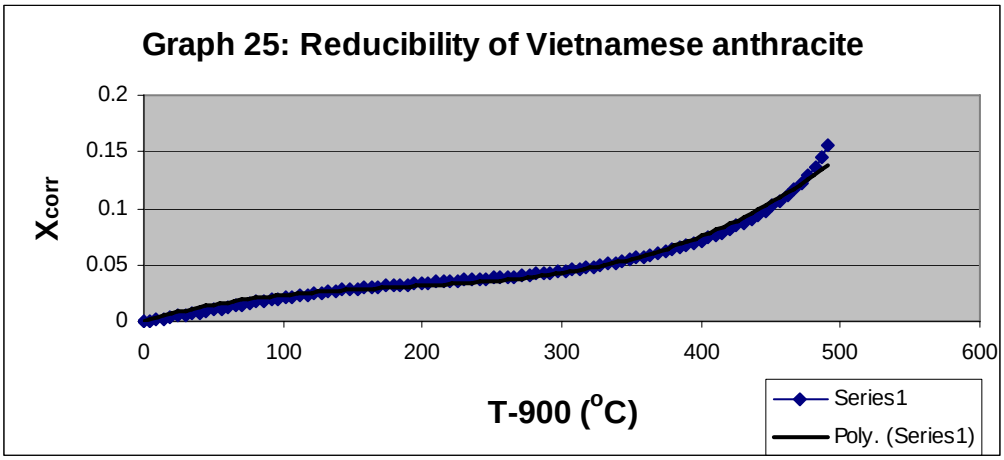
$T_0 = 1463.132$ ^{o}K

and $S^2 = 6.059277 \times 10^{-20}$

5.4 Determination of the reactivity of Vietnamese anthracite.

199.4 mg of sintered chromite ore and 47.7mg of Vietnamese anthracite was used. The mixture contains 20% excess carbon required to react with Cr_2O_3 and FeO and Fe_2O_3 in the chromite ore . The reaction mixture was heated in an alumina sample holder from room temperature to the selected reaction temperature at a heating rate of 10^{o}C per minute, and then held for 120 minutes. The selected temperatures were 1190^{o}C, 1240^{o}C, 1290^{o}C, 1340^{o}C and 1390^{o}C.

Determination of the fraction reduction with temperature to account for the reduction occurred from 900°C to the selected temperature is as mentioned in section 5.1.



Graph 25: Reduction of sintered chromite ore using Vietnamese anthracite.

The fit yields:

$$X_{corr} = 0.00036830645389(T-900) - 1.661003844\times10^{-6}(T-900)^2 + 3.025550\times10^{-9}(T-900)^3$$

$R^2 = 0.98983565$

and hence:

Table 10: Values of X_{corr} at different temperatures.

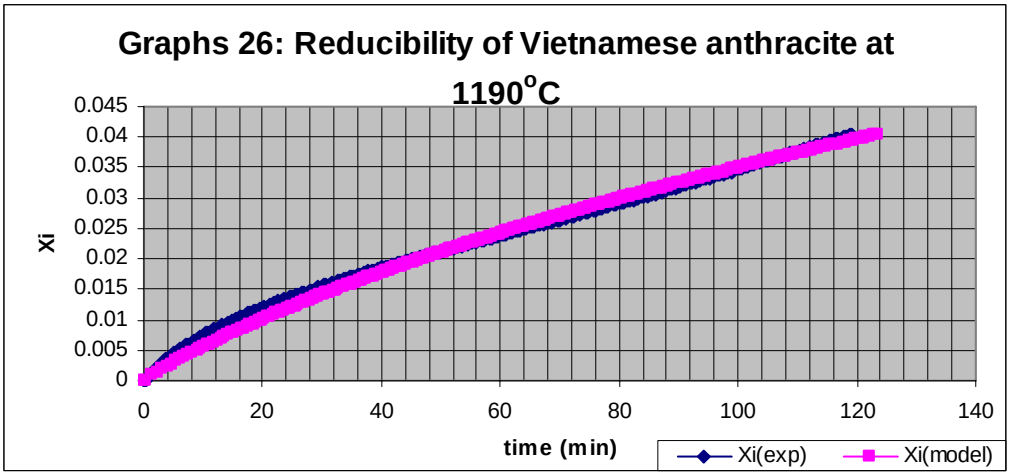
T (°C)	X_{corr}
1190	0.040909
1240	0.052128
1290	0.070473
1340	0.098213
1390	0.137616

5.4.1 Determination of τ and σ_s^2 at 1190°C

X_{corr} at 1190°C = 0.040909

X_i (at 1190°C) = X_i (from 900°C) – 0.040909

The generated data in appendix 20 was fitted into equation [2] (as shown in graph 26) using the sum of least squares of equation [15]



Graph 26 : Reduction of sintered chromite ore at 1190°C.

The fit yields:

$\tau = 4949$

$\sigma_s^2 = 20.36654$

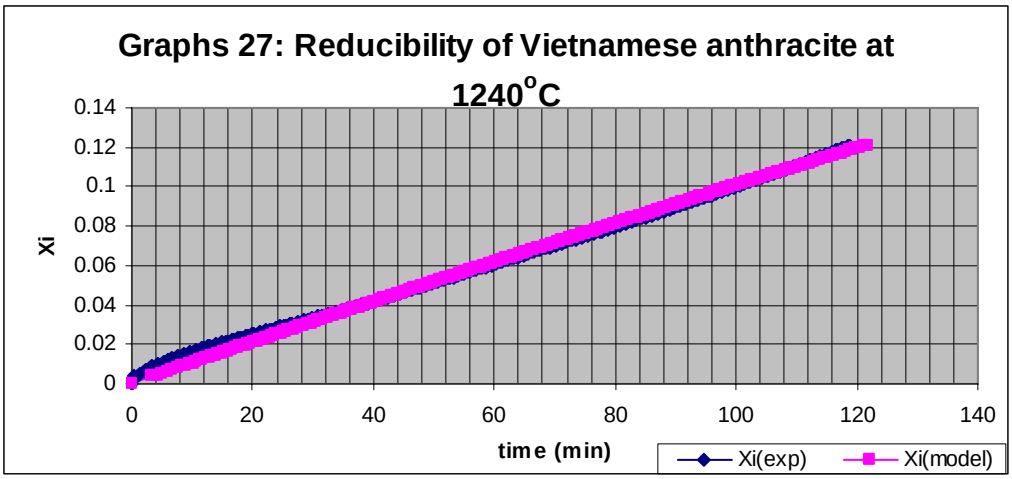
and $S^2 = 1934.07057$

5.4.2 Determination of τ and σ_s^2 at 1240°C

X_{corr} at 1240°C = 0.052128

X_i (at 1240°C) = X_i (from 900°C) – 0.052128

The generated data in appendix 21 was fitted into equation [2] (as shown in graph 27) through equation [15].



Graph 27 : Reduction of sintered chromite ore at 1240°C.

The fit yields:

$\tau = 2842$

$\sigma_s^2 = 0.142153$

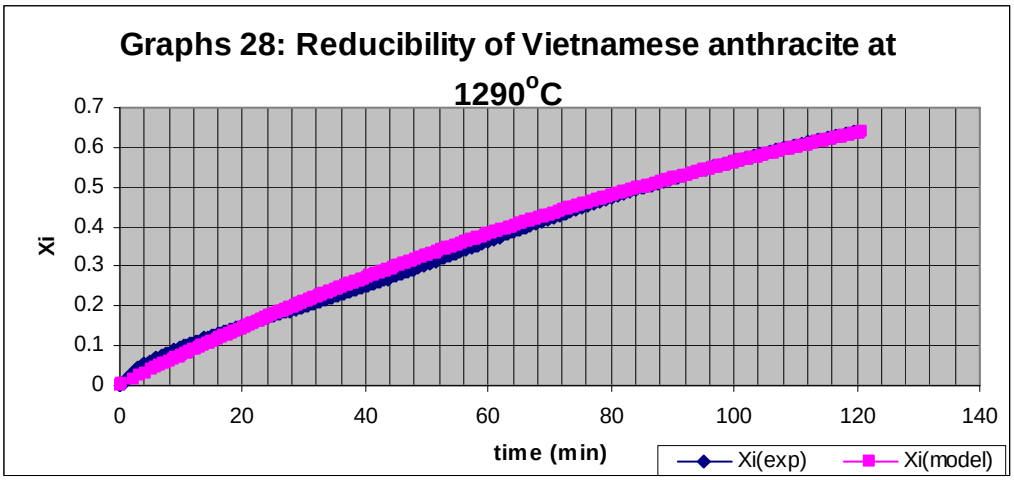
and $S^2 = 1462.1046$

5.4.3 Determination of τ and σ_s^2 at 1290°C

X_{corr} at 1290°C = 0.070473

X_i (at 1290°C) = X_i (from 900°C) – 0.070473

The generated data in appendix 22 was fitted into equation [2] (as shown in graph 28) using the sum of least squares equation [15].



Graph 28 : Reduction of sintered chromite ore at 1290°C.

The fit yields:

$\tau = 388.3$

$\sigma_s^2 = 0.120268$

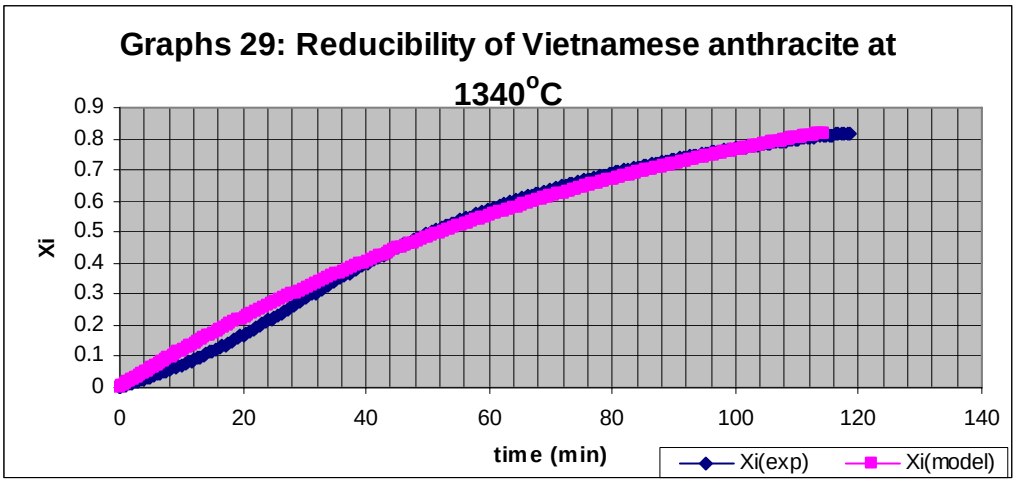
and $S^2 = 1152.6086$

5.4.4 Determination of τ and σ_s^2 at 1340°C

X_{corr} at 1340°C = 0.098213

X_i (at 1340°C) = X_i (from 900°C) – 0.098213

The generated data in appendix 23 was fitted into equation [2] (as shown in graph 29) using the sum of least squares of equation [15].



Graph 29 : Reduction of sintered chromite ore at 1340°C.

The fit yields:

$\tau = 241.1$

$\sigma_s^2 = 0.100$

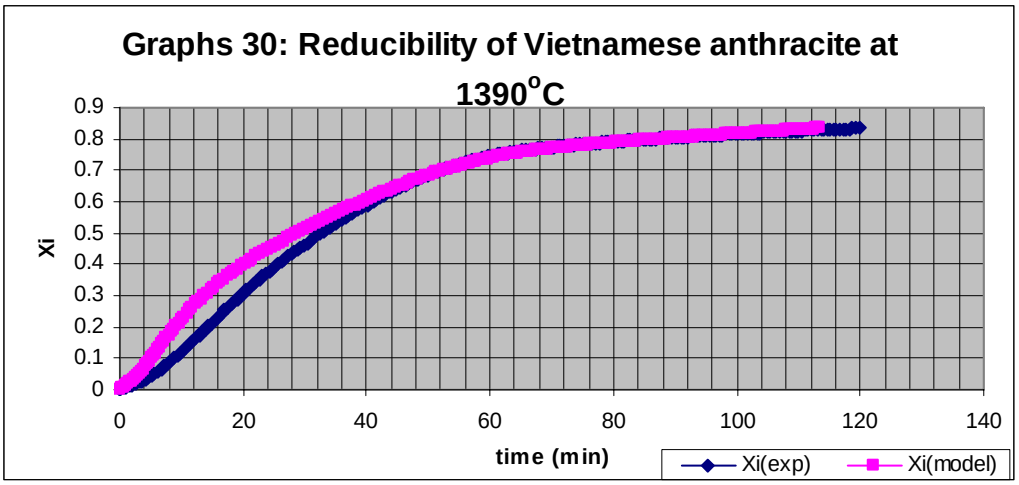
and $S^2 = 2298.5379$

5.4.5 Determination of τ and σ_s^2 at 1390°C

X_{corr} at 1390°C = 0.137616

X_i (at 1390°C) = X_i (from 900°C) – 0.137616

The generated data in appendix 24 was fitted into equation [2] (as shown in graph 30) using the sum of least squares of equation [15].



Graph 30 : Reduction of sintered chromite ore at 1390°C.

The fit yields:

$\tau = 187.9$

$\sigma_s^2 = 0.10644$

and $S^2 = 30562.24$

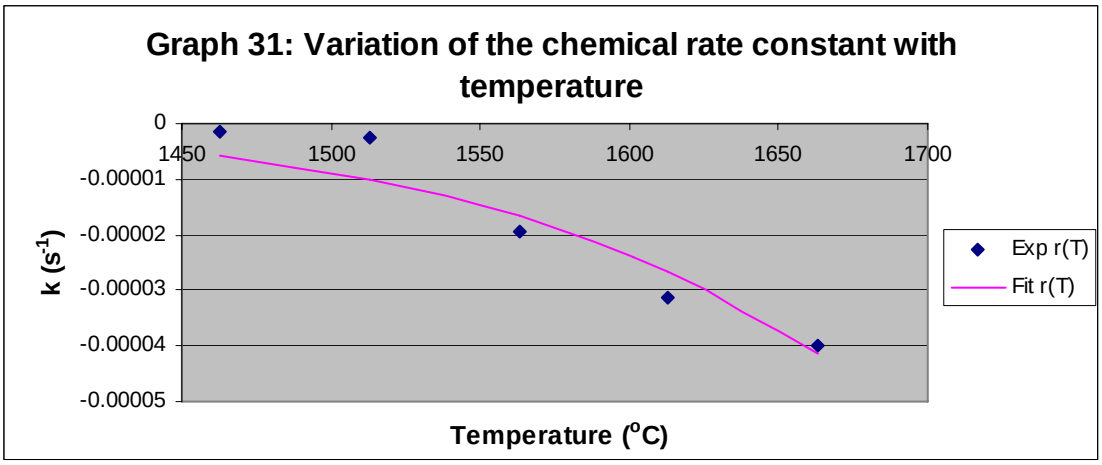
5.4.6 Determination of ΔE (for chemical reaction) and ΔE (for diffusion) .

From equation [7] and equation [8], the values of the chemical reaction rate constant (k , in s^{-1}), and the effective diffusion coefficient (D_e , in ms^{-1}) are obtained at different temperatures and are as follows:

Table 11: Values of k and D_e at different temperatures

Temp (^oC)	τ (min)	τ (s)	σ_s^2	k (s^{-1})	D_e ($m.s^{-1}$)
1190	4949	296940	20.36654	1.51728×10^{-6}	3.91416×10^{-13}
1240	2842	170520	0.142153	2.64216×10^{-6}	9.76547×10^{-11}
1290	388.3	23298	0.120268	1.93382×10^{-5}	8.44803×10^{-10}
1340	241.1	14466	0.100	3.11448×10^{-5}	1.63635×10^{-9}
1390	187.9	11274	0.10644	3.99628×10^{-5}	1.97261×10^{-9}

The values of k at different temperatures were fitted into Equation [1] (as shown in graph 31) using the sum of least squares of equation [16]



Graph 31: Variation of the chemical reaction rate constant (k, in s^{-1}) with temperature.

The fit yields:

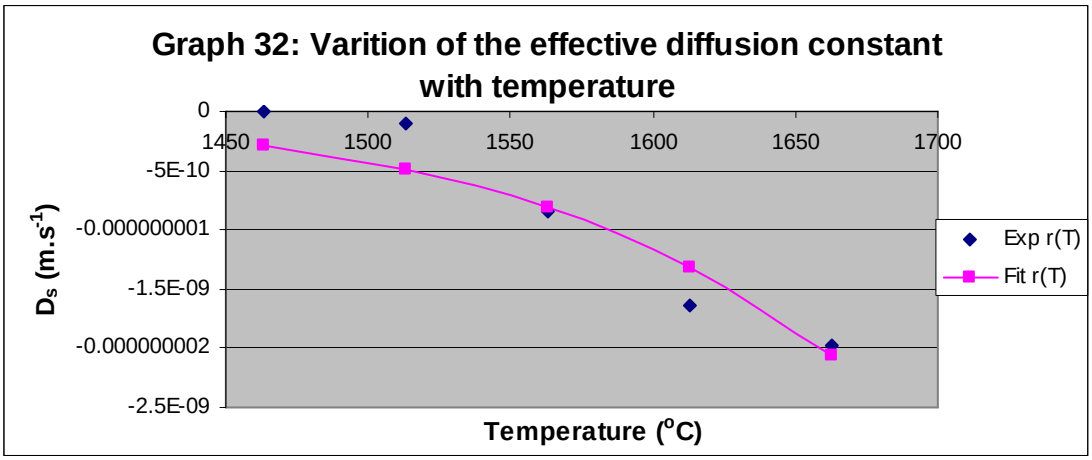
$\Delta E = 197024.2$ J/mol (for chemical reaction)

$k_o = 5.92088\times10^{-6}$ s^{-1}

$T_0 = 1463.132$ ^oK

and $S^2 = 1.04396\times10^{-10}$

The values of D_e at different temperatures were also fitted into Equation [1] (as shown in graph 32) through equation [17].



Graph 32: Variation of the effective diffusion coefficient (D_e , in ms^{-1}) with temperature.

The fit yields:

$\Delta E = 200057$ J/mol (for diffusion)

$D_e = 2.84626 \times 10^{-10}$ m.s^{-1}

$T_0 = 1463.132$ ^{o}K

and $S^2 = 3.469368 \times 10^{-19}$

CHAPTER 6: DISCUSION OF RESULTS

The values of the activation energies obtained from fitting the data into the Arrhenius equation was then used to determine the relative reactivity of the reductants. The values of the chemical reaction rate constant and effective diffusion constant were used to determine the relative speed at which the reductants can reduce the chromite ore. The summary of the results of the TGA tests are as follows:

Table 12: Summary of the TGA test results.

	Chemical reaction		Effective diffusion	
Reductant	ΔE	k_o	ΔE	D_e
Vietnamese anthracite	197 024.2	5.9209×10^{-6}	200 057	2.8463×10^{-10}
China nuts coke	212 435.6	5.1286×10^{-6}	213 134.3	1.0236×10^{-10}
Springlake anthracite	217 507.6	6.9758×10^{-6}	260 252.7	6.0210×10^{-11}
Argentine coke	201 813.4	6.0097×10^{-6}	306 809.4	9.9634×10^{-11}

The TGA tests suggest that the Vietnamese anthracite has the highest reactivity since its activation energies are the lowest and requires less energy to induce the reductant reaction. The reduction of $FeCr_2O_4$ by activated carbon in argon atmosphere was studied by C.P.J. Van Vuuren[17]. The activation energy of the reaction was found to be 197 kJ/mol, which is in good agreement to the activation energy values obtained in the TGA tests.

The tests also suggest that the rate controlling mechanism is the diffusion of species to the reactive site since the effective diffusion constant is of the order 10^{-10} to 10^{-11}, which is far less than the chemical rate constant of the order 10^{-6}. A generalized rate model developed to describe the reduction of chromite shows that at given particle size and up

to a reduction of 40%, the rate of reduction is controlled mainly by interfacial-area chemical reaction, and after which the rate is dominated by diffusion[7].

The tests also suggest that the Vietnamese anthracite is the fastest to react since its effective diffusion constant is high, and Argentine coke being the less reactive and slowest to react (highest activation energy and lowest effective diffusion constant).

CHAPTER 7: CONCLUSION

The TGA tests suggested that the Vietnamese anthracite has the highest relative reactivity followed by China nuts coke only. Since the rate controlling mechanism is diffusion of species to the reactive site, then Vietnames anthracite is the fastest to react followed by China nuts, and Argentine coke being the slowest to react.

Tests were also conducted in the smelter furnace to determine if the performance of the reductant is with accordance to the TGA tests analysis. In performing these tests, 10 to 30% (in terms of fixed carbon) of China nuts being used in the furnace was substituted with the reductant under study. Another test was carried out whereby the China nuts coke was completely substituted with Argentine coke. The sizing of the material was kept at -40+10mm.

Due to management of the company considering these tests as their competitive advantage, the tests were considered highly confidential. The publishing of the data of the smelter furnace operation during these tests was not approved. Overall the results of the tests done in the smelter furnace were in good agreement to those obtained in the TGA tests.

Hence the TGA test can be used to determine the reactivity of the reductant to a higher degree of confidence. The values of the chemical rate constant and effective diffusion constant obtained in the TGA tests can be used in deciding on the material size to be used, especially when one wants to maintain a stable coke bed underneath the electrodes. Follow-up tests involving the resistivity of the reductant will have to be done to establish the total performance of the reductant and its usability.

Overall, the investigation showed that anthracite has a significant potential to substitute coke as a reductant of choice. This is also supported by the fact that anthracite is used as one of the raw material in the production of a submerged arc furnace electrode paste.

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APPENDIX 1: Data for the reactivity of Argentine coke.

##Temp./- C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(µ V/mW)	Segment	Mass change (mg)	Mass loss (mg)	CO evolved (mg)	X_i	T-900 (^oC)	X_i
888.440	86.867	99.446	0.180	0.258	1.000	256.868	1.432				
893.568	87.381	99.434	0.183	0.257	1.000	256.838	1.462				
898.725	87.895	99.422	0.186	0.256	1.000	256.806	1.494	0.000	0.000	0.000	0.000
903.876	88.409	99.409	0.189	0.255	1.000	256.774	1.526	0.032	0.000	3.876	0.0004
909.023	88.923	99.395	0.192	0.254	1.000	256.736	1.564	0.070	0.001	9.023	0.0009
914.170	89.437	99.381	0.194	0.253	1.000	256.700	1.600	0.106	0.001	14.170	0.0014
919.305	89.951	99.367	0.198	0.252	1.000	256.666	1.634	0.140	0.002	19.305	0.0018
924.444	90.465	99.353	0.202	0.251	1.000	256.628	1.672	0.179	0.002	24.444	0.0023
929.595	90.979	99.337	0.203	0.249	1.000	256.588	1.712	0.218	0.003	29.595	0.0029
934.737	91.493	99.323	0.206	0.248	1.000	256.552	1.748	0.254	0.003	34.737	0.0033
939.886	92.007	99.309	0.208	0.247	1.000	256.514	1.786	0.292	0.004	39.886	0.0038
945.019	92.521	99.291	0.211	0.246	1.000	256.468	1.832	0.338	0.004	45.019	0.0044
950.153	93.035	99.274	0.213	0.245	1.000	256.425	1.875	0.381	0.005	50.153	0.0050
955.296	93.549	99.257	0.215	0.244	1.000	256.380	1.920	0.426	0.006	55.296	0.0056
960.431	94.063	99.237	0.218	0.242	1.000	256.330	1.970	0.476	0.006	60.431	0.0062
965.582	94.577	99.216	0.220	0.241	1.000	256.276	2.024	0.530	0.007	65.582	0.0069
970.709	95.091	99.196	0.222	0.240	1.000	256.224	2.076	0.583	0.008	70.709	0.0076
975.866	95.605	99.174	0.224	0.239	1.000	256.168	2.132	0.639	0.008	75.866	0.0084
981.013	96.119	99.153	0.226	0.238	1.000	256.112	2.188	0.694	0.009	81.013	0.0091
986.151	96.633	99.129	0.228	0.236	1.000	256.051	2.249	0.756	0.010	86.151	0.0099
991.300	97.147	99.106	0.230	0.235	1.000	255.990	2.310	0.816	0.011	91.300	0.0107
996.443	97.661	99.079	0.232	0.234	1.000	255.922	2.378	0.884	0.012	96.443	0.0116
1001.590	98.175	99.053	0.234	0.232	1.000	255.855	2.445	0.952	0.012	101.590	0.0124
1006.740	98.689	99.029	0.237	0.231	1.000	255.792	2.508	1.014	0.013	106.740	0.0133
1011.885	99.203	98.999	0.239	0.230	1.000	255.714	2.586	1.092	0.014	111.885	0.0143
1017.045	99.717	98.968	0.241	0.229	1.000	255.635	2.665	1.172	0.015	117.045	0.0153
1022.195	100.231	98.936	0.244	0.227	1.000	255.552	2.748	1.254	0.016	122.195	0.0164
1027.328	100.745	98.903	0.246	0.226	1.000	255.467	2.833	1.339	0.018	127.328	0.0175
1032.500	101.259	98.870	0.248	0.224	1.000	255.382	2.918	1.424	0.019	132.500	0.0186
1037.627	101.773	98.833	0.250	0.223	1.000	255.286	3.014	1.520	0.020	137.627	0.0199
1042.778	102.287	98.798	0.250	0.222	1.000	255.194	3.106	1.612	0.021	142.778	0.0211
1047.908	102.801	98.758	0.253	0.220	1.000	255.092	3.208	1.715	0.022	147.908	0.022
1053.068	103.315	98.717	0.253	0.219	1.000	254.987	3.313	1.819	0.024	153.068	0.024
1058.198	103.829	98.678	0.256	0.217	1.000	254.886	3.414	1.920	0.025	158.198	0.025
1063.335	104.343	98.638	0.258	0.216	1.000	254.781	3.519	2.025	0.026	163.335	0.026
1068.483	104.857	98.598	0.259	0.215	1.000	254.678	3.622	2.128	0.028	168.483	0.028
1073.606	105.371	98.554	0.259	0.213	1.000	254.564	3.736	2.243	0.029	173.606	0.029
1078.769	105.885	98.514	0.259	0.212	1.000	254.463	3.837	2.344	0.031	178.769	0.031
1083.908	106.399	98.474	0.260	0.210	1.000	254.358	3.942	2.448	0.032	183.908	0.032
1089.056	106.913	98.436	0.261	0.209	1.000	254.260	4.040	2.547	0.033	189.056	0.033
1094.176	107.427	98.399	0.262	0.207	1.000	254.165	4.135	2.641	0.035	194.176	0.035
1099.319	107.941	98.365	0.262	0.206	1.000	254.076	4.224	2.731	0.036	199.319	0.036
1104.462	108.455	98.331	0.263	0.204	1.000	253.990	4.310	2.816	0.037	204.462	0.037
1109.615	108.969	98.299	0.264	0.203	1.000	253.906	4.394	2.900	0.038	209.615	0.038

1114.760	109.483	98.270	0.265	0.201	1.000	253.831	4.469	2.976	0.039	214.760	0.039
1119.894	109.997	98.243	0.265	0.200	1.000	253.762	4.538	3.044	0.040	219.894	0.040
1125.043	110.511	98.218	0.265	0.198	1.000	253.698	4.602	3.108	0.041	225.043	0.041
1130.182	111.025	98.193	0.265	0.197	1.000	253.632	4.668	3.175	0.042	230.182	0.042
1135.327	111.539	98.170	0.265	0.195	1.000	253.574	4.726	3.232	0.042	235.327	0.042
1140.471	112.053	98.147	0.266	0.194	1.000	253.514	4.786	3.292	0.043	240.471	0.043
1145.621	112.567	98.126	0.267	0.192	1.000	253.460	4.840	3.347	0.044	245.621	0.044
1150.756	113.081	98.108	0.268	0.190	1.000	253.412	4.888	3.395	0.044	250.756	0.044
1155.896	113.595	98.087	0.268	0.189	1.000	253.358	4.942	3.449	0.045	255.896	0.045
1161.040	114.109	98.065	0.270	0.187	1.000	253.302	4.998	3.504	0.046	261.040	0.046
1166.179	114.623	98.045	0.272	0.186	1.000	253.251	5.049	3.555	0.046	266.179	0.046
1171.320	115.137	98.026	0.273	0.184	1.000	253.202	5.098	3.604	0.047	271.320	0.047
1176.471	115.652	98.004	0.274	0.183	1.000	253.144	5.156	3.662	0.048	276.471	0.048
1181.599	116.166	97.981	0.276	0.181	1.000	253.084	5.216	3.723	0.049	281.599	0.049
1186.748	116.680	97.961	0.277	0.179	1.000	253.034	5.266	3.772	0.049	286.748	0.049
1191.892	117.194	97.936	0.277	0.178	1.000	252.968	5.332	3.838	0.050	291.892	0.050
1197.029	117.708	97.910	0.279	0.176	1.000	252.902	5.398	3.904	0.051	297.029	0.051
1202.172	118.222	97.885	0.282	0.175	1.000	252.836	5.464	3.970	0.052	302.172	0.052
1207.305	118.736	97.858	0.285	0.173	1.000	252.766	5.534	4.040	0.053	307.305	0.053
1212.453	119.250	97.829	0.287	0.171	1.000	252.692	5.608	4.114	0.054	312.453	0.054
1217.596	119.764	97.795	0.290	0.170	1.000	252.606	5.694	4.201	0.055	317.596	0.055
1222.740	120.278	97.763	0.293	0.168	1.000	252.522	5.778	4.285	0.056	322.740	0.056
1227.886	120.792	97.730	0.294	0.166	1.000	252.436	5.864	4.371	0.057	327.886	0.057
1233.022	121.306	97.695	0.297	0.165	1.000	252.346	5.954	4.461	0.058	333.022	0.058
1238.165	121.820	97.657	0.299	0.163	1.000	252.248	6.052	4.558	0.060	338.165	0.060
1243.301	122.334	97.619	0.302	0.162	1.000	252.151	6.149	4.656	0.061	343.301	0.061
1248.453	122.848	97.577	0.305	0.160	1.000	252.040	6.260	4.766	0.062	348.453	0.062
1253.601	123.362	97.530	0.307	0.158	1.000	251.919	6.381	4.887	0.064	353.601	0.064
1258.736	123.876	97.486	0.311	0.157	1.000	251.806	6.494	5.001	0.065	358.736	0.065
1263.889	124.390	97.436	0.314	0.155	1.000	251.676	6.624	5.130	0.067	363.889	0.067
1269.009	124.904	97.383	0.317	0.153	1.000	251.540	6.760	5.266	0.069	369.009	0.069
1274.164	125.418	97.322	0.320	0.152	1.000	251.382	6.918	5.424	0.071	374.164	0.071
1279.300	125.932	97.264	0.321	0.150	1.000	251.234	7.066	5.573	0.073	379.300	0.073
1284.441	126.446	97.195	0.324	0.149	1.000	251.054	7.246	5.752	0.075	384.441	0.075
1289.583	126.960	97.120	0.327	0.147	1.000	250.862	7.438	5.944	0.078	389.583	0.078
1294.721	127.474	97.043	0.334	0.145	1.000	250.661	7.639	6.145	0.080	394.721	0.080
1299.870	127.988	96.957	0.342	0.144	1.000	250.440	7.860	6.367	0.083	399.870	0.083
1305.008	128.502	96.864	0.355	0.142	1.000	250.199	8.101	6.607	0.086	405.008	0.086
1310.140	129.016	96.757	0.371	0.140	1.000	249.922	8.378	6.884	0.090	410.140	0.090
1315.287	129.530	96.640	0.388	0.139	1.000	249.622	8.678	7.184	0.094	415.287	0.094
1320.431	130.044	96.512	0.409	0.137	1.000	249.290	9.010	7.517	0.098	420.431	0.098
1325.559	130.558	96.368	0.426	0.136	1.000	248.917	9.383	7.889	0.103	425.559	0.103
1330.689	131.072	96.211	0.447	0.134	1.000	248.512	9.788	8.294	0.108	430.689	0.108
1335.841	131.586	96.043	0.472	0.132	1.000	248.080	10.220	8.727	0.114	435.841	0.114
1340.994	132.100	95.858	0.498	0.131	1.000	247.600	10.700	9.206	0.120	440.994	0.120
1346.120	132.614	95.658	0.528	0.129	1.000	247.084	11.216	9.723	0.127	446.120	0.127
1351.268	133.128	95.434	0.561	0.128	1.000	246.507	11.793	10.300	0.135	451.268	0.135
1356.412	133.642	95.195	0.599	0.126	1.000	245.888	12.412	10.918	0.143	456.412	0.143

1361.551	134.156	94.935	0.640	0.125	1.000	245.217	13.083	11.589	0.152	461.551	0.152
1366.701	134.670	94.654	0.686	0.123	1.000	244.492	13.808	12.314	0.161	466.701	0.161
1371.828	135.184	94.349	0.738	0.121	1.000	243.704	14.596	13.102	0.171	471.828	0.171
1376.983	135.698	94.021	0.796	0.120	1.000	242.857	15.443	13.949	0.182	476.983	0.182
1382.117	136.212	93.665	0.867	0.118	1.000	241.936	16.364	14.870	0.194	482.117	0.194
1387.257	136.726	93.227	0.947	0.117	1.000	240.806	17.494	16.000	0.209	487.257	0.209
1390.742	137.240	92.812	1.006	0.116	1.000	239.734	18.566	17.072	0.223	490.742	0.223

APPENDIX 2: Data for the reactivity of Argentine coke at 1190^{o}C.

									bouyancy					
Temp./-C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	mg CO evolved	%R / X	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1188.388	116.847	97.942	0.3582	0.17881	1	253.572	5.328	3.838	0	0	0	0	0	0
1191.488	117.320	97.922	0.36685	0.17784	2	253.521	5.379	3.889	0.04292	0.00000	0.00000	1.03E-12	0.003	0.473
1191.612	117.793	97.899	0.50015	0.17781	2	253.461	5.439	3.949	0.04358	0.00066	0.00022	1.47E-07	1.316	0.946
1191.168	118.266	97.882	0.60599	0.17794	2	253.416	5.484	3.994	0.04407	0.00116	0.00039	4.48E-07	2.298	1.419
1190.983	118.739	97.864	0.61615	0.178	2	253.369	5.531	4.041	0.04460	0.00168	0.00056	9.46E-07	3.341	1.892
1190.864	119.212	97.847	0.62003	0.17804	2	253.326	5.574	4.084	0.04507	0.00215	0.00072	1.55E-06	4.272	2.365
1190.737	119.685	97.832	0.62566	0.17808	2	253.286	5.614	4.124	0.04551	0.00259	0.00086	2.24E-06	5.146	2.838
1190.638	120.158	97.816	0.63051	0.17811	2	253.245	5.655	4.165	0.04596	0.00305	0.00102	3.1E-06	6.054	3.311
1190.548	120.631	97.802	0.63591	0.17814	2	253.209	5.691	4.200	0.04636	0.00344	0.00115	3.95E-06	6.834	3.785
1190.466	121.104	97.789	0.64083	0.17816	2	253.175	5.725	4.235	0.04674	0.00382	0.00128	4.88E-06	7.593	4.258
1190.410	121.577	97.776	0.64575	0.17818	2	253.141	5.759	4.269	0.04711	0.00420	0.00140	5.88E-06	8.339	4.731
1190.337	122.050	97.761	0.65092	0.1782	2	253.104	5.796	4.306	0.04752	0.00461	0.00154	7.08E-06	9.155	5.204
1190.288	122.523	97.747	0.65531	0.17822	2	253.068	5.832	4.342	0.04792	0.00500	0.00167	8.36E-06	9.947	5.677
1190.250	122.996	97.735	0.66089	0.17823	2	253.036	5.864	4.374	0.04827	0.00535	0.00179	9.57E-06	10.646	6.150
1190.199	123.470	97.723	0.66682	0.17825	2	253.004	5.896	4.406	0.04863	0.00571	0.00191	1.09E-05	11.364	6.623
1190.170	123.943	97.712	0.67123	0.17826	2	252.976	5.924	4.434	0.04893	0.00601	0.00201	1.21E-05	11.964	7.096
1190.151	124.416	97.702	0.67569	0.17826	2	252.951	5.949	4.459	0.04921	0.00630	0.00210	1.33E-05	12.535	7.569
1190.132	124.889	97.691	0.68109	0.17827	2	252.922	5.978	4.488	0.04953	0.00662	0.00221	1.46E-05	13.173	8.042
1190.103	125.362	97.680	0.68654	0.17828	2	252.893	6.007	4.517	0.04985	0.00693	0.00232	1.61E-05	13.804	8.515
1190.089	125.835	97.671	0.69186	0.17828	2	252.869	6.031	4.541	0.05011	0.00719	0.00240	1.73E-05	14.327	8.988
1190.071	126.308	97.660	0.69706	0.17829	2	252.843	6.057	4.567	0.05040	0.00749	0.00250	1.88E-05	14.916	9.461
1190.058	126.781	97.648	0.70168	0.17829	2	252.812	6.088	4.598	0.05075	0.00783	0.00262	2.05E-05	15.604	9.934
1190.049	127.254	97.638	0.70652	0.17829	2	252.785	6.115	4.625	0.05104	0.00813	0.00272	2.21E-05	16.196	10.407
1190.035	127.727	97.629	0.71152	0.1783	2	252.761	6.139	4.649	0.05130	0.00839	0.00280	2.35E-05	16.720	10.880
1190.025	128.200	97.620	0.7163	0.1783	2	252.737	6.163	4.673	0.05157	0.00865	0.00289	2.51E-05	17.252	11.354
1190.022	128.673	97.609	0.72174	0.1783	2	252.709	6.191	4.701	0.05188	0.00897	0.00300	2.69E-05	17.884	11.827
1190.020	129.146	97.599	0.72645	0.1783	2	252.684	6.216	4.726	0.05215	0.00924	0.00309	2.86E-05	18.419	12.300
1190.000	129.619	97.589	0.73167	0.17831	2	252.658	6.242	4.752	0.05245	0.00953	0.00319	3.04E-05	19.013	12.773
1190.012	130.092	97.581	0.73699	0.17831	2	252.637	6.263	4.773	0.05268	0.00976	0.00326	3.19E-05	19.476	13.246
1190.007	130.565	97.572	0.74201	0.17831	2	252.615	6.285	4.795	0.05292	0.01000	0.00335	3.35E-05	19.962	13.719
1190.010	131.039	97.563	0.74626	0.17831	2	252.590	6.310	4.820	0.05320	0.01028	0.00344	3.54E-05	20.517	14.192
1190.005	131.512	97.552	0.75098	0.17831	2	252.563	6.337	4.847	0.05349	0.01057	0.00354	3.74E-	21.100	14.665

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1190.000	131.985	97.545	0.75644	0.17831	2	252.544	6.356	4.866	0.05370	0.01079	0.00361	3.9E-05	21.537	15.138
1190.005	132.458	97.536	0.76209	0.17831	2	252.520	6.380	4.890	0.05397	0.01105	0.00370	4.09E-05	22.068	15.611
1190.002	132.931	97.527	0.76679	0.17831	2	252.498	6.402	4.911	0.05420	0.01129	0.00378	4.27E-05	22.541	16.084
1190.005	133.404	97.519	0.77161	0.17831	2	252.476	6.424	4.934	0.05445	0.01153	0.00386	4.45E-05	23.030	16.557
1190.008	133.877	97.510	0.77766	0.17831	2	252.453	6.447	4.957	0.05471	0.01179	0.00395	4.66E-05	23.555	17.030
1190.001	134.350	97.502	0.78296	0.17831	2	252.432	6.468	4.978	0.05494	0.01203	0.00402	4.85E-05	24.029	17.503
1189.991	134.823	97.494	0.78738	0.17831	2	252.412	6.488	4.998	0.05516	0.01224	0.00410	5.02E-05	24.467	17.976
1189.985	135.296	97.485	0.79247	0.17831	2	252.390	6.510	5.020	0.05540	0.01249	0.00418	5.23E-05	24.958	18.449
1190.002	135.769	97.476	0.79721	0.17831	2	252.366	6.534	5.044	0.05566	0.01275	0.00427	5.45E-05	25.479	18.923
1189.998	136.242	97.469	0.80176	0.17831	2	252.347	6.553	5.063	0.05588	0.01296	0.00434	5.63E-05	25.917	19.396
1189.992	136.715	97.460	0.80648	0.17831	2	252.325	6.575	5.085	0.05612	0.01320	0.00442	5.84E-05	26.400	19.869
1190.005	137.188	97.453	0.81125	0.17831	2	252.305	6.595	5.105	0.05633	0.01342	0.00449	6.04E-05	26.838	20.342
1190.000	137.661	97.444	0.81674	0.17831	2	252.284	6.616	5.126	0.05657	0.01366	0.00457	6.26E-05	27.322	20.815
1189.988	138.134	97.436	0.82209	0.17831	2	252.262	6.638	5.148	0.05681	0.01390	0.00465	6.48E-05	27.805	21.288
1189.998	138.608	97.428	0.82703	0.17831	2	252.240	6.660	5.170	0.05705	0.01414	0.00473	6.7E-05	28.289	21.761
1190.001	139.081	97.419	0.83107	0.17831	2	252.218	6.682	5.192	0.05729	0.01438	0.00482	6.93E-05	28.773	22.234
1189.991	139.554	97.412	0.83645	0.17831	2	252.199	6.701	5.211	0.05751	0.01459	0.00489	7.15E-05	29.212	22.707
1189.997	140.027	97.403	0.84114	0.17831	2	252.177	6.723	5.233	0.05775	0.01483	0.00497	7.38E-05	29.695	23.180
1189.994	140.500	97.396	0.8467	0.17831	2	252.157	6.743	5.253	0.05797	0.01505	0.00504	7.6E-05	30.141	23.653
1189.991	140.973	97.389	0.85177	0.17831	2	252.141	6.759	5.269	0.05814	0.01523	0.00510	7.78E-05	30.495	24.126
1190.000	141.446	97.382	0.8558	0.17831	2	252.122	6.778	5.288	0.05835	0.01544	0.00517	8E-05	30.922	24.599
1189.998	141.919	97.373	0.86109	0.17831	2	252.098	6.802	5.312	0.05862	0.01570	0.00526	8.28E-05	31.452	25.072
1190.011	142.392	97.365	0.86664	0.17831	2	252.079	6.821	5.331	0.05884	0.01592	0.00534	8.51E-05	31.897	25.545
1189.992	142.865	97.357	0.87168	0.17831	2	252.057	6.843	5.353	0.05908	0.01616	0.00542	8.77E-05	32.382	26.018
1189.994	143.338	97.350	0.87612	0.17831	2	252.039	6.861	5.371	0.05928	0.01636	0.00548	8.99E-05	32.787	26.492
1190.000	143.811	97.342	0.88089	0.17831	2	252.019	6.881	5.391	0.05949	0.01657	0.00556	9.22E-05	33.220	26.965
1189.991	144.284	97.335	0.88628	0.17831	2	252.001	6.899	5.409	0.05969	0.01678	0.00562	9.45E-05	33.634	27.438
1189.998	144.757	97.329	0.89018	0.17831	2	251.986	6.914	5.424	0.05986	0.01694	0.00568	9.64E-05	33.972	27.911
1189.991	145.230	97.321	0.89492	0.17831	2	251.963	6.937	5.447	0.06011	0.01720	0.00577	9.94E-05	34.486	28.384
1189.995	145.704	97.313	0.89977	0.17831	2	251.944	6.956	5.466	0.06032	0.01740	0.00584	0.000102	34.905	28.857
1189.999	146.177	97.305	0.90485	0.17831	2	251.923	6.977	5.487	0.06055	0.01764	0.00591	0.000105	35.375	29.330
1189.988	146.650	97.298	0.90955	0.17831	2	251.905	6.995	5.505	0.06076	0.01784	0.00598	0.000107	35.789	29.803
1189.986	147.123	97.290	0.91486	0.17831	2	251.884	7.016	5.526	0.06098	0.01807	0.00606	0.00011	36.251	30.276
1189.989	147.596	97.282	0.91907	0.17831	2	251.863	7.037	5.547	0.06121	0.01830	0.00614	0.000113	36.716	30.749
1190.003	148.069	97.275	0.92409	0.17831	2	251.845	7.055	5.565	0.06141	0.01849	0.00620	0.000115	37.116	31.222
1190.004	148.542	97.268	0.92927	0.17831	2	251.826	7.074	5.584	0.06162	0.01870	0.00627	0.00011	37.544	31.695

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1190.009	149.015	97.260	0.9346	0.17831	2	251.806	7.094	5.604	0.06184	0.01892	0.00635	0.00012	37.993	32.168
1190.004	149.488	97.253	0.93958	0.17831	2	251.787	7.113	5.623	0.06205	0.01914	0.00642	0.00012 3	38.425	32.641
1189.997	149.961	97.244	0.94416	0.17831	2	251.765	7.135	5.645	0.06229	0.01938	0.00650	0.00012 6	38.915	33.114
1189.991	150.434	97.237	0.94878	0.17831	2	251.748	7.152	5.662	0.06249	0.01957	0.00657	0.00012 9	39.307	33.588
1189.993	150.907	97.231	0.9529	0.17831	2	251.730	7.170	5.680	0.06268	0.01977	0.00663	0.00013 1	39.709	34.061
1189.989	151.380	97.223	0.95815	0.17831	2	251.711	7.189	5.699	0.06290	0.01998	0.00671	0.00013 4	40.147	34.534
1189.995	151.853	97.217	0.96381	0.17831	2	251.696	7.204	5.714	0.06306	0.02015	0.00676	0.00013 7	40.482	35.007
1189.995	152.326	97.209	0.96858	0.17831	2	251.673	7.227	5.737	0.06331	0.02040	0.00685	0.00014	40.987	35.480
1189.993	152.799	97.200	0.97338	0.17831	2	251.651	7.249	5.759	0.06355	0.02064	0.00693	0.00014 3	41.476	35.953
1189.994	153.273	97.193	0.97827	0.17831	2	251.633	7.267	5.777	0.06375	0.02083	0.00699	0.00014 6	41.883	36.426
1189.998	153.746	97.186	0.98308	0.17831	2	251.614	7.286	5.796	0.06396	0.02105	0.00706	0.00014 9	42.313	36.899
1190.003	154.219	97.179	0.98766	0.17831	2	251.597	7.303	5.813	0.06415	0.02124	0.00713	0.00015 2	42.704	37.372
1189.995	154.692	97.172	0.9924	0.17831	2	251.579	7.321	5.831	0.06435	0.02143	0.00720	0.00015 5	43.107	37.845
1189.991	155.165	97.166	0.99704	0.17831	2	251.561	7.339	5.848	0.06454	0.02163	0.00726	0.00015 7	43.500	38.318
1189.989	155.638	97.158	1.00181	0.17831	2	251.543	7.357	5.867	0.06475	0.02184	0.00733	0.00016 1	43.927	38.791
1189.995	156.111	97.151	1.00718	0.17831	2	251.524	7.376	5.886	0.06496	0.02204	0.00740	0.00016 4	44.349	39.264
1190.003	156.584	97.144	1.01185	0.17831	2	251.505	7.395	5.905	0.06516	0.02225	0.00747	0.00016 7	44.771	39.737
1189.999	157.057	97.137	1.01635	0.17831	2	251.487	7.413	5.923	0.06537	0.02245	0.00754	0.00017	45.187	40.210
1189.997	157.530	97.129	1.02104	0.17831	2	251.466	7.434	5.944	0.06559	0.02268	0.00762	0.00017 3	45.649	40.683
1190.003	158.003	97.120	1.02564	0.17831	2	251.444	7.456	5.966	0.06584	0.02292	0.00770	0.00017 7	46.142	41.157
1190.006	158.476	97.113	1.03089	0.17831	2	251.427	7.473	5.983	0.06603	0.02312	0.00777	0.00018	46.543	41.630
1189.999	158.949	97.106	1.03641	0.17831	2	251.407	7.493	6.003	0.06625	0.02333	0.00784	0.00018 3	46.985	42.103
1190.003	159.422	97.097	1.04138	0.17831	2	251.385	7.515	6.025	0.06649	0.02357	0.00792	0.00018 7	47.479	42.576
1190.003	159.895	97.090	1.0459	0.17831	2	251.365	7.535	6.045	0.06671	0.02380	0.00800	0.00019 1	47.938	43.049
1189.994	160.368	97.084	1.05069	0.17831	2	251.350	7.550	6.060	0.06688	0.02397	0.00805	0.00019 4	48.281	43.522
1190.001	160.842	97.075	1.05555	0.17831	2	251.327	7.573	6.083	0.06713	0.02421	0.00814	0.00019 8	48.782	43.995
1190.004	161.315	97.068	1.0605	0.17831	2	251.308	7.592	6.102	0.06734	0.02443	0.00821	0.00020 1	49.224	44.468
1190.012	161.788	97.060	1.06496	0.17831	2	251.289	7.611	6.121	0.06755	0.02463	0.00828	0.00020 4	49.643	44.941
1189.993	162.261	97.054	1.0699	0.17831	2	251.273	7.627	6.137	0.06773	0.02481	0.00834	0.00020 8	50.016	45.414
1190.002	162.734	97.047	1.07407	0.17831	2	251.253	7.647	6.157	0.06794	0.02503	0.00841	0.00021 1	50.456	45.887
1190.003	163.207	97.039	1.07942	0.17831	2	251.235	7.665	6.175	0.06815	0.02523	0.00848	0.00021 5	50.878	46.360
1190.012	163.680	97.031	1.08459	0.17831	2	251.214	7.686	6.196	0.06838	0.02546	0.00856	0.00021 9	51.348	46.833
1190.023	164.153	97.025	1.08952	0.1783	2	251.198	7.702	6.212	0.06855	0.02564	0.00862	0.00022 2	51.705	47.306
1190.006	164.626	97.017	1.09442	0.17831	2	251.178	7.722	6.232	0.06878	0.02586	0.00870	0.00022 6	52.168	47.779
1189.991	165.099	97.010	1.09988	0.17831	2	251.159	7.741	6.251	0.06899	0.02607	0.00877	0.00022 9	52.598	48.252

1190.011	165.572	97.004	1.10383	0.17831	2	251.143	7.757	6.267	0.06916	0.02624	0.00882	0.00023 2	52.949	48.726
1189.999	166.045	96.997	1.10906	0.17831	2	251.124	7.776	6.285	0.06937	0.02645	0.00890	0.00023 6	53.377	49.199
1190.005	166.518	96.988	1.11413	0.17831	2	251.101	7.799	6.309	0.06962	0.02671	0.00898	0.00024 1	53.908	49.672
1189.994	166.991	96.981	1.11907	0.17831	2	251.084	7.816	6.326	0.06981	0.02690	0.00905	0.00024 4	54.297	50.145
1189.992	167.464	96.974	1.12274	0.17831	2	251.066	7.834	6.344	0.07001	0.02710	0.00912	0.00024 8	54.711	50.618
1190.013	167.937	96.966	1.12781	0.1783	2	251.044	7.856	6.366	0.07025	0.02734	0.00920	0.00025 2	55.204	51.091
1189.995	168.411	96.959	1.13351	0.17831	2	251.027	7.873	6.383	0.07044	0.02753	0.00926	0.00025 6	55.590	51.564
1189.997	168.884	96.953	1.13785	0.17831	2	251.013	7.887	6.397	0.07060	0.02769	0.00931	0.00025 9	55.917	52.037
1189.998	169.357	96.944	1.14263	0.17831	2	250.987	7.913	6.423	0.07088	0.02797	0.00941	0.00026 4	56.502	52.510
1190.014	169.830	96.938	1.14727	0.1783	2	250.971	7.929	6.439	0.07105	0.02814	0.00947	0.00026 7	56.851	52.983
1189.999	170.303	96.931	1.15252	0.17831	2	250.956	7.944	6.454	0.07123	0.02831	0.00953	0.00027 1	57.212	53.456
1190.004	170.776	96.924	1.15772	0.17831	2	250.936	7.964	6.474	0.07145	0.02853	0.00960	0.00027 5	57.662	53.929
1190.003	171.249	96.917	1.16287	0.17831	2	250.918	7.982	6.492	0.07164	0.02873	0.00967	0.00027 9	58.065	54.402
1189.997	171.722	96.910	1.16698	0.17831	2	250.900	8.000	6.510	0.07184	0.02892	0.00974	0.00028 2	58.467	54.875
1190.001	172.195	96.902	1.17186	0.17831	2	250.879	8.021	6.531	0.07208	0.02916	0.00982	0.00028 7	58.962	55.348
1189.996	172.668	96.896	1.17723	0.17831	2	250.863	8.037	6.547	0.07225	0.02934	0.00988	0.00029 1	59.321	55.821
1190.007	173.141	96.887	1.18238	0.17831	2	250.841	8.059	6.569	0.07249	0.02957	0.00996	0.00029 5	59.810	56.295
1190.001	173.614	96.880	1.18718	0.17831	2	250.821	8.079	6.588	0.07271	0.02979	0.01003	0.0003	60.264	56.768
1190.001	174.087	96.873	1.19214	0.17831	2	250.803	8.097	6.607	0.07291	0.02999	0.01010	0.00030 4	60.675	57.241
1189.984	174.560	96.867	1.19709	0.17831	2	250.790	8.110	6.620	0.07306	0.03015	0.01015	0.00030 7	60.992	57.714
1189.989	175.033	96.861	1.20206	0.17831	2	250.773	8.127	6.637	0.07325	0.03033	0.01022	0.00031 1	61.379	58.187
1189.995	175.506	96.852	1.20671	0.17831	2	250.751	8.149	6.659	0.07349	0.03058	0.01030	0.00031 6	61.878	58.660
1190.001	175.980	96.846	1.2107	0.17831	2	250.733	8.167	6.677	0.07368	0.03077	0.01036	0.00032	62.277	59.133
1189.994	176.453	96.836	1.21631	0.17831	2	250.708	8.192	6.702	0.07396	0.03105	0.01046	0.00032 6	62.855	59.606
1189.994	176.926	96.829	1.22144	0.17831	2	250.691	8.209	6.719	0.07415	0.03124	0.01052	0.00033	63.245	60.079
1190.003	177.399	96.822	1.22549	0.17831	2	250.672	8.228	6.738	0.07436	0.03144	0.01059	0.00033 4	63.669	60.552
1190.000	177.872	96.814	1.23015	0.17831	2	250.652	8.248	6.758	0.07458	0.03167	0.01067	0.00033 9	64.134	61.025
1190.002	178.345	96.808	1.23565	0.17831	2	250.635	8.265	6.775	0.07476	0.03185	0.01073	0.00034 3	64.511	61.498
1190.005	178.818	96.802	1.24059	0.17831	2	250.620	8.280	6.790	0.07493	0.03201	0.01079	0.00034 7	64.856	61.971
1190.008	179.291	96.794	1.24537	0.17831	2	250.601	8.299	6.809	0.07514	0.03223	0.01086	0.00035 1	65.301	62.444
1190.006	179.764	96.788	1.25025	0.17831	2	250.584	8.316	6.825	0.07532	0.03241	0.01092	0.00035 5	65.673	62.917
1189.991	180.237	96.780	1.25478	0.17831	2	250.565	8.335	6.845	0.07554	0.03263	0.01100	0.00036	66.129	63.390
1190.001	180.710	96.772	1.25936	0.17831	2	250.542	8.358	6.868	0.07579	0.03288	0.01108	0.00036 6	66.638	63.864
1189.998	181.183	96.764	1.26459	0.17831	2	250.522	8.378	6.888	0.07602	0.03310	0.01116	0.00037 1	67.105	64.337
1189.997	181.656	96.757	1.2693	0.17831	2	250.504	8.396	6.906	0.07621	0.03330	0.01122	0.00037 5	67.514	64.810
1190.000	182.129	96.749	1.2738	0.17831	2	250.484	8.416	6.926	0.07643	0.03351	0.01130	0.00038	67.963	65.283

1189.997	182.602	96.743	1.27916	0.17831	2	250.468	8.432	6.942	0.07661	0.03370	0.01136	0.000384	68.340	65.756
1190.006	183.076	96.736	1.28373	0.17831	2	250.448	8.452	6.962	0.07683	0.03391	0.01143	0.000389	68.791	66.229
1190.009	183.549	96.728	1.28826	0.17831	2	250.428	8.472	6.982	0.07705	0.03413	0.01151	0.000394	69.248	66.702
1190.000	184.022	96.721	1.29373	0.17831	2	250.412	8.488	6.998	0.07723	0.03431	0.01157	0.000399	69.625	67.175
1189.994	184.495	96.713	1.29891	0.17831	2	250.390	8.510	7.020	0.07747	0.03456	0.01166	0.000404	70.134	67.648
1189.996	184.968	96.705	1.30316	0.17831	2	250.369	8.531	7.041	0.07770	0.03478	0.01173	0.00041	70.601	68.121
1190.000	185.441	96.698	1.30795	0.17831	2	250.351	8.549	7.059	0.07790	0.03499	0.01180	0.000414	71.022	68.594
1189.996	185.914	96.691	1.31345	0.17831	2	250.332	8.568	7.078	0.07811	0.03520	0.01187	0.00042	71.463	69.067
1189.999	186.387	96.684	1.31784	0.17831	2	250.315	8.585	7.095	0.07829	0.03538	0.01193	0.000424	71.837	69.540
1190.008	186.860	96.678	1.32261	0.17831	2	250.300	8.600	7.110	0.07847	0.03555	0.01199	0.000428	72.200	70.013
1190.002	187.333	96.672	1.32777	0.17831	2	250.284	8.616	7.126	0.07864	0.03572	0.01205	0.000432	72.550	70.486
1190.001	187.806	96.665	1.33296	0.17831	2	250.266	8.634	7.144	0.07884	0.03593	0.01212	0.000437	72.977	70.960
1189.999	188.279	96.656	1.33777	0.17831	2	250.243	8.657	7.167	0.07909	0.03618	0.01221	0.000443	73.496	71.433
1190.000	188.752	96.649	1.34247	0.17831	2	250.223	8.677	7.187	0.07931	0.03640	0.01228	0.000449	73.958	71.906
1190.004	189.225	96.643	1.34813	0.17831	2	250.208	8.692	7.202	0.07948	0.03657	0.01234	0.000453	74.316	72.379
1190.003	189.698	96.637	1.35305	0.17831	2	250.194	8.706	7.216	0.07964	0.03672	0.01239	0.000457	74.631	72.852
1190.005	190.171	96.630	1.35758	0.17831	2	250.175	8.725	7.235	0.07984	0.03693	0.01246	0.000462	75.063	73.325
1189.994	190.645	96.622	1.36231	0.17831	2	250.154	8.746	7.256	0.08007	0.03716	0.01254	0.000468	75.546	73.798
1189.999	191.118	96.616	1.36737	0.17831	2	250.138	8.762	7.272	0.08025	0.03734	0.01260	0.000473	75.916	74.271
1190.003	191.591	96.609	1.37221	0.17831	2	250.121	8.779	7.289	0.08044	0.03752	0.01267	0.000477	76.307	74.744
1189.995	192.064	96.601	1.37709	0.17831	2	250.100	8.800	7.310	0.08067	0.03775	0.01275	0.000483	76.784	75.217
1190.003	192.537	96.594	1.38197	0.17831	2	250.083	8.817	7.327	0.08086	0.03795	0.01281	0.000488	77.186	75.690
1190.000	193.010	96.589	1.38624	0.17831	2	250.069	8.831	7.341	0.08101	0.03810	0.01286	0.000492	77.508	76.163
1189.990	193.483	96.581	1.39111	0.17831	2	250.049	8.851	7.361	0.08124	0.03832	0.01294	0.000498	77.970	76.636
1189.989	193.956	96.574	1.39549	0.17831	2	250.029	8.871	7.381	0.08145	0.03854	0.01302	0.000504	78.428	77.109
1190.006	194.429	96.567	1.40047	0.17831	2	250.012	8.888	7.398	0.08164	0.03872	0.01308	0.000509	78.813	77.582
1190.000	194.902	96.559	1.40611	0.17831	2	249.990	8.910	7.420	0.08188	0.03897	0.01316	0.000515	79.325	78.055
1189.990	195.375	96.551	1.41112	0.17831	2	249.972	8.928	7.438	0.08209	0.03917	0.01323	0.000521	79.753	78.529
1189.993	195.848	96.546	1.41631	0.17831	2	249.957	8.943	7.453	0.08225	0.03934	0.01329	0.000525	80.099	79.002
1189.997	196.321	96.539	1.42081	0.17831	2	249.939	8.961	7.471	0.08245	0.03953	0.01336	0.00053	80.503	79.475
1190.014	196.794	96.531	1.42537	0.1783	2	249.919	8.981	7.491	0.08267	0.03976	0.01343	0.000536	80.977	79.948
1190.008	197.267	96.524	1.43005	0.17831	2	249.901	8.999	7.509	0.08287	0.03995	0.01350	0.000542	81.377	80.421
1190.000	197.740	96.515	1.43535	0.17831	2	249.877	9.023	7.533	0.08314	0.04022	0.01359	0.000549	81.946	80.894
1189.998	198.214	96.510	1.44026	0.17831	2	249.863	9.037	7.547	0.08328	0.04037	0.01364	0.000553	82.253	81.367
1189.996	198.687	96.503	1.44521	0.17831	2	249.846	9.054	7.564	0.08348	0.04056	0.01371	0.000559	82.663	81.840

1189.999	199.160	96.497	1.44983	0.17831	2	249.832	9.068	7.578	0.08363	0.04072	0.01376	0.000563	82.981	82.313
1189.998	199.633	96.490	1.45458	0.17831	2	249.814	9.086	7.596	0.08383	0.04092	0.01383	0.000568	83.403	82.786
1189.997	200.106	96.483	1.45922	0.17831	2	249.794	9.106	7.616	0.08405	0.04114	0.01391	0.000575	83.867	83.259
1190.000	200.579	96.474	1.46416	0.17831	2	249.772	9.128	7.638	0.08429	0.04137	0.01399	0.000581	84.362	83.732
1189.998	201.052	96.467	1.469	0.17831	2	249.754	9.146	7.656	0.08449	0.04157	0.01405	0.000587	84.774	84.205
1189.992	201.525	96.459	1.47453	0.17831	2	249.733	9.167	7.677	0.08473	0.04181	0.01414	0.000594	85.278	84.678
1189.995	201.998	96.452	1.47877	0.17831	2	249.715	9.185	7.695	0.08492	0.04200	0.01420	0.000599	85.681	85.151
1190.000	202.471	96.447	1.48384	0.17831	2	249.701	9.199	7.709	0.08507	0.04215	0.01425	0.000604	85.999	85.624
1190.002	202.944	96.441	1.49011	0.17831	2	249.685	9.215	7.724	0.08525	0.04233	0.01431	0.000609	86.368	86.098
1189.993	203.417	96.433	1.49441	0.17831	2	249.666	9.234	7.744	0.08546	0.04255	0.01439	0.000615	86.825	86.571
1189.999	203.890	96.428	1.49945	0.17831	2	249.652	9.248	7.758	0.08561	0.04270	0.01444	0.00062	87.144	87.044
1190.007	204.363	96.420	1.50403	0.17831	2	249.632	9.268	7.778	0.08583	0.04292	0.01452	0.000626	87.600	87.517
1189.998	204.836	96.412	1.51021	0.17831	2	249.611	9.289	7.799	0.08607	0.04316	0.01460	0.000633	88.104	87.990
1190.003	205.309	96.405	1.51428	0.17831	2	249.593	9.307	7.817	0.08627	0.04335	0.01467	0.000639	88.519	88.463
1190.006	205.783	96.398	1.51942	0.17831	2	249.575	9.325	7.835	0.08646	0.04355	0.01473	0.000645	88.928	88.936
1190.002	206.256	96.391	1.52375	0.17831	2	249.555	9.345	7.855	0.08668	0.04377	0.01481	0.000651	89.386	89.409
1190.007	206.729	96.384	1.529	0.17831	2	249.538	9.362	7.872	0.08688	0.04396	0.01487	0.000657	89.798	89.882
1189.999	207.202	96.376	1.53443	0.17831	2	249.518	9.382	7.892	0.08710	0.04418	0.01495	0.000664	90.258	90.355
1190.006	207.675	96.371	1.53917	0.17831	2	249.504	9.396	7.906	0.08725	0.04434	0.01500	0.000669	90.592	90.828
1190.010	208.148	96.365	1.54374	0.17831	2	249.489	9.411	7.921	0.08742	0.04450	0.01506	0.000674	90.937	91.301
1190.005	208.621	96.356	1.54843	0.17831	2	249.467	9.433	7.943	0.08766	0.04474	0.01514	0.000681	91.446	91.774
1190.005	209.094	96.351	1.55329	0.17831	2	249.453	9.447	7.957	0.08782	0.04490	0.01520	0.000686	91.778	92.247
1190.002	209.567	96.343	1.55796	0.17831	2	249.432	9.468	7.978	0.08804	0.04513	0.01527	0.000693	92.254	92.720
1189.997	210.040	96.336	1.56354	0.17831	2	249.413	9.487	7.997	0.08826	0.04534	0.01535	0.000699	92.704	93.193
1190.000	210.513	96.331	1.56885	0.17831	2	249.400	9.500	8.010	0.08840	0.04548	0.01540	0.000704	93.007	93.667
1190.005	210.986	96.322	1.5736	0.17831	2	249.377	9.523	8.033	0.08865	0.04574	0.01548	0.000712	93.538	94.140
1190.002	211.459	96.316	1.57887	0.17831	2	249.361	9.539	8.049	0.08883	0.04591	0.01554	0.000717	93.910	94.613
1190.008	211.932	96.310	1.58348	0.17831	2	249.346	9.554	8.064	0.08899	0.04608	0.01560	0.000723	94.253	95.086
1190.009	212.405	96.304	1.58901	0.17831	2	249.330	9.570	8.080	0.08917	0.04625	0.01566	0.000728	94.624	95.559
1190.001	212.879	96.297	1.59379	0.17831	2	249.313	9.587	8.097	0.08935	0.04644	0.01573	0.000734	95.019	96.032
1189.999	213.352	96.290	1.59841	0.17831	2	249.294	9.606	8.116	0.08957	0.04665	0.01580	0.000741	95.476	96.505
1190.002	213.825	96.283	1.60354	0.17831	2	249.275	9.625	8.134	0.08977	0.04686	0.01587	0.000747	95.901	96.978
1190.008	214.298	96.276	1.60824	0.17831	2	249.257	9.643	8.153	0.08997	0.04705	0.01594	0.000754	96.323	97.451
1190.003	214.771	96.270	1.61246	0.17831	2	249.243	9.657	8.167	0.09013	0.04722	0.01599	0.000759	96.665	97.924

1190.001	215.244	96.264	1.61746	0.17831	2	249.227	9.673	8.183	0.09031	0.04739	0.01605	0.000765	97.038	98.397
1189.988	215.717	96.256	1.62292	0.17831	2	249.207	9.693	8.203	0.09052	0.04761	0.01613	0.000772	97.493	98.870
1189.996	216.190	96.249	1.62726	0.17831	2	249.188	9.712	8.222	0.09074	0.04782	0.01620	0.000779	97.949	99.343
1190.004	216.663	96.241	1.63216	0.17831	2	249.167	9.733	8.243	0.09097	0.04806	0.01628	0.000787	98.442	99.816
1189.999	217.136	96.232	1.63757	0.17831	2	249.146	9.754	8.264	0.09120	0.04829	0.01636	0.000794	98.929	100.289
1190.000	217.609	96.225	1.64123	0.17831	2	249.128	9.772	8.282	0.09140	0.04849	0.01643	0.000801	99.357	100.762
1190.007	218.082	96.219	1.64551	0.17831	2	249.110	9.790	8.300	0.09160	0.04868	0.01650	0.000808	99.769	101.236
1190.015	218.555	96.212	1.65119	0.1783	2	249.092	9.808	8.318	0.09179	0.04888	0.01657	0.000814	100.183	101.709
1190.004	219.028	96.205	1.6562	0.17831	2	249.074	9.826	8.336	0.09199	0.04908	0.01663	0.000821	100.602	102.182
1189.998	219.501	96.198	1.66085	0.17831	2	249.057	9.843	8.353	0.09218	0.04926	0.01670	0.000827	101.002	102.655
1189.998	219.974	96.190	1.66584	0.17831	2	249.037	9.863	8.373	0.09241	0.04949	0.01678	0.000835	101.485	103.128
1189.993	220.448	96.183	1.67103	0.17831	2	249.018	9.882	8.392	0.09261	0.04969	0.01685	0.000842	101.908	103.601
1190.004	220.921	96.178	1.67614	0.17831	2	249.005	9.895	8.405	0.09275	0.04984	0.01690	0.000847	102.220	104.074
1190.001	221.394	96.171	1.68079	0.17831	2	248.987	9.913	8.423	0.09296	0.05004	0.01697	0.000854	102.652	104.547
1189.998	221.867	96.164	1.68547	0.17831	2	248.968	9.932	8.442	0.09316	0.05024	0.01704	0.000861	103.079	105.020
1190.007	222.340	96.158	1.69031	0.17831	2	248.953	9.947	8.457	0.09333	0.05042	0.01710	0.000867	103.445	105.493
1189.994	222.813	96.150	1.69496	0.17831	2	248.933	9.967	8.477	0.09355	0.05064	0.01717	0.000875	103.918	105.966
1189.997	223.286	96.142	1.69985	0.17831	2	248.913	9.987	8.497	0.09377	0.05086	0.01725	0.000882	104.382	106.439
1190.001	223.759	96.137	1.70454	0.17831	2	248.898	10.002	8.512	0.09393	0.05102	0.01730	0.000888	104.726	106.912
1189.994	224.232	96.130	1.70927	0.17831	2	248.881	10.019	8.529	0.09413	0.05121	0.01737	0.000895	105.140	107.385
1189.999	224.705	96.123	1.71481	0.17831	2	248.862	10.038	8.548	0.09434	0.05142	0.01744	0.000902	105.583	107.858
1190.000	225.178	96.117	1.72034	0.17831	2	248.847	10.053	8.563	0.09450	0.05158	0.01750	0.000908	105.926	108.332
1189.993	225.651	96.110	1.72536	0.17831	2	248.829	10.071	8.581	0.09470	0.05179	0.01757	0.000915	106.358	108.805
1189.997	226.124	96.102	1.73009	0.17831	2	248.809	10.091	8.601	0.09492	0.05200	0.01764	0.000923	106.822	109.278
1189.992	226.597	96.097	1.73521	0.17831	2	248.795	10.105	8.615	0.09507	0.05216	0.01770	0.000928	107.143	109.751
1189.990	227.070	96.090	1.73996	0.17831	2	248.776	10.124	8.634	0.09528	0.05237	0.01777	0.000936	107.595	110.224
1190.002	227.543	96.082	1.7445	0.17831	2	248.757	10.143	8.653	0.09549	0.05257	0.01784	0.000944	108.035	110.697
1190.009	228.017	96.076	1.74961	0.17831	2	248.742	10.158	8.668	0.09566	0.05274	0.01790	0.00095	108.399	111.170
1190.007	228.490	96.070	1.75478	0.17831	2	248.726	10.174	8.684	0.09583	0.05292	0.01796	0.000956	108.762	111.643
1189.997	228.963	96.064	1.75998	0.17831	2	248.709	10.191	8.701	0.09602	0.05311	0.01802	0.000963	109.168	112.116
1190.001	229.436	96.056	1.76412	0.17831	2	248.688	10.212	8.722	0.09625	0.05334	0.01810	0.000971	109.662	112.589
1189.996	229.909	96.050	1.76859	0.17831	2	248.672	10.228	8.738	0.09643	0.05351	0.01816	0.000978	110.031	113.062
1189.991	230.382	96.043	1.77404	0.17831	2	248.655	10.245	8.755	0.09662	0.05370	0.01823	0.000985	110.436	113.535
1189.997	230.855	96.036	1.77877	0.17831	2	248.638	10.262	8.772	0.09681	0.05389	0.01830	0.000992	110.847	114.008

1189.996	231.328	96.027	1.78399	0.17831	2	248.613	10.287	8.797	0.09708	0.05417	0.01839	0.001002	111.429	114.481
1190.001	231.801	96.021	1.78905	0.17831	2	248.600	10.300	8.810	0.09723	0.05431	0.01844	0.001008	111.747	114.954
1189.999	232.274	96.014	1.79426	0.17831	2	248.580	10.320	8.830	0.09745	0.05454	0.01852	0.001016	112.220	115.427
1190.006	232.747	96.008	1.79916	0.17831	2	248.564	10.336	8.846	0.09762	0.05470	0.01858	0.001022	112.576	115.901
1190.005	233.220	96.002	1.80363	0.17831	2	248.550	10.350	8.860	0.09777	0.05486	0.01863	0.001028	112.907	116.374
1189.993	233.693	95.995	1.8085	0.17831	2	248.532	10.368	8.878	0.09797	0.05506	0.01870	0.001036	113.335	116.847
1190.010	234.166	95.988	1.81355	0.17831	2	248.513	10.387	8.897	0.09819	0.05527	0.01877	0.001044	113.796	117.320
1190.003	234.639	95.982	1.81881	0.17831	2	248.497	10.403	8.913	0.09836	0.05544	0.01883	0.001051	114.161	117.793
1190.008	235.112	95.976	1.82369	0.17831	2	248.481	10.419	8.929	0.09854	0.05562	0.01890	0.001058	114.544	118.266
1190.004	235.586	95.967	1.82859	0.17831	2	248.458	10.442	8.952	0.09880	0.05588	0.01899	0.001068	115.098	118.739
1189.993	236.059	95.963	1.83357	0.17831	2	248.448	10.452	8.962	0.09890	0.05599	0.01902	0.001072	115.327	119.212
1190.015	236.532	95.955	1.838	0.1783	2	248.428	10.472	8.982	0.09912	0.05621	0.01910	0.00108	115.796	119.685

APPENDIX 3: Data for the reactivity of Argentine coke at 1240^{o}C.

											bouyancy			
Temp./-C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	mg CO evolved	%R\X	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1241.4472	122.69894	97.56284	0.39176	0.16212	2	252.88288	6.31712	4.60744	0	0	0	0	0	0
1240.97291	123.182	97.54113	0.52764	0.16227	2	252.82661	6.37339	4.66371	0.0608586	0.00037656	0.0001255	4.727E-08	0.2811219	0.48306
1240.81469	123.66507	97.51765	0.53214	0.16232	2	252.76575	6.43425	4.72457	0.0616527	0.00117075	0.0003904	4.571E-07	0.8743196	0.96613
1240.6961	124.14814	97.49393	0.53404	0.16236	2	252.70427	6.49573	4.78605	0.0624551	0.00197305	0.0006581	1.299E-06	1.4739867	1.4492
1240.58698	124.6312	97.47229	0.53774	0.16239	2	252.64818	6.55182	4.84214	0.063187	0.00270501	0.0009025	2.442E-06	2.0214256	1.93226
1240.48626	125.11427	97.45189	0.53978	0.16243	2	252.59530	6.60470	4.89502	0.063877	0.00339502	0.001133	3.848E-06	2.5378074	2.41533
1240.41244	125.59734	97.43331	0.54183	0.16245	2	252.54714	6.65286	4.94318	0.0645055	0.00402347	0.001343	5.406E-06	3.0083835	2.8984
1240.34629	126.0804	97.41352	0.5457	0.16247	2	252.49584	6.70416	4.99447	0.0651748	0.00469284	0.0015667	7.356E-06	3.5098819	3.38146
1240.29039	126.56347	97.39509	0.54851	0.16249	2	252.44807	6.75193	5.04224	0.0657982	0.00531622	0.0017752	9.443E-06	3.9771735	3.86453
1240.24028	127.04654	97.37641	0.55149	0.1625	2	252.39965	6.80035	5.09066	0.0664301	0.00594805	0.0019866	1.182E-05	4.451057	4.3476
1240.20417	127.5296	97.35792	0.55508	0.16252	2	252.35173	6.84827	5.13859	0.0670555	0.00657346	0.002196	1.445E-05	4.9203716	4.83066
1240.16542	128.01267	97.34118	0.55785	0.16253	2	252.30834	6.89166	5.18198	0.0676217	0.00713967	0.0023856	1.705E-05	5.3454834	5.31373
1240.12449	128.49574	97.32379	0.5606	0.16254	2	252.26326	6.93674	5.22705	0.0682099	0.00772787	0.0025826	1.998E-05	5.7873193	5.7968
1240.10149	128.9788	97.30781	0.56348	0.16255	2	252.22184	6.97816	5.26847	0.0687504	0.00826838	0.0027638	2.287E-05	6.193526	6.27986
1240.08927	129.46187	97.29089	0.56663	0.16255	2	252.17799	7.02201	5.31233	0.0693227	0.00884069	0.0029556	2.616E-05	6.6238315	6.76293
1240.0819	129.94494	97.27166	0.56998	0.16255	2	252.12814	7.07186	5.36217	0.0699731	0.00949112	0.0031738	3.015E-05	7.1131397	7.246
1240.07037	130.428	97.25441	0.57341	0.16256	2	252.08343	7.11657	5.40689	0.0705566	0.01007459	0.0033695	3.398E-05	7.552298	7.72906
1240.06085	130.91107	97.23797	0.57728	0.16256	2	252.04082	7.15918	5.44950	0.0711127	0.01063065	0.0035562	3.785E-05	7.9710387	8.21213
1240.0417	131.39414	97.22042	0.58112	0.16257	2	251.99533	7.20467	5.49499	0.0717063	0.01122426	0.0037555	4.221E-05	8.4182717	8.6952
1240.02527	131.8772	97.20504	0.58343	0.16257	2	251.95546	7.24454	5.53485	0.0722265	0.01174448	0.0039303	4.622E-05	8.8103926	9.17826
1240.01445	132.36027	97.18855	0.58625	0.16258	2	251.91272	7.28728	5.57760	0.0727842	0.01230224	0.0041177	5.073E-05	9.2310073	9.66133
1240.01952	132.84334	97.17135	0.59015	0.16257	2	251.86814	7.33186	5.62218	0.073366	0.01288401	0.0043132	5.565E-05	9.6699461	10.1444
1240.01626	133.3264	97.15456	0.59348	0.16258	2	251.82462	7.37538	5.66570	0.0739339	0.01345191	0.0045042	6.068E-05	10.098633	10.62746
1240.00963	133.80947	97.13568	0.59628	0.16258	2	251.77568	7.42432	5.71463	0.0745725	0.01409051	0.0047191	6.66E-05	10.580931	11.11053
1240.00863	134.29254	97.11899	0.60021	0.16258	2	251.73242	7.46758	5.75789	0.075137	0.01465504	0.0049091	7.206E-05	11.007505	11.5936
1240.00461	134.7756	97.10296	0.60367	0.16258	2	251.69087	7.50913	5.79944	0.0756792	0.01519723	0.0050916	7.751E-05	11.417404	12.07666
1240.0061	135.25867	97.08475	0.60724	0.16258	2	251.64367	7.55633	5.84664	0.0762952	0.01581317	0.0052991	8.394E-05	11.883279	12.55973
1240.00272	135.74174	97.06594	0.61024	0.16258	2	251.59492	7.60508	5.89540	0.0769314	0.01644 94	0.0055135	9.086E-05	12.364762	13.0428
1239.98877	136.2248	97.04805	0.61306	0.16258	2	251.54855	7.65145	5.94177	0.0775365	0.01705451	0.0057175	9.769E-05	12.82294	13.52586
1239.99154	136.70787	97.03234	0.61654	0.16258	2	251.50783	7.69217	5.98249	0.0780679	0.01758589	0.0058967	0.0001039	13.225483	14.00893
1240.00	137.19094	97.0153	0.61999	0.16258	2	251.46366	7.73634	6.02666	0.0786	0.01816	0.0060	0.00011	13.662313	14.492

089									442	225	911	09		
1239.99569	137.674	96.99787	0.62356	0.16258	2	251.41848	7.78152	6.07184	0.0792338	0.0187518	0.0062901	0.0001182	14.109365	14.97506
1240.00514	138.15707	96.97998	0.62661	0.16258	2	251.37211	7.82789	6.11821	0.0798389	0.0193569	0.0064944	0.000126	14.56845	15.45813
1240.00413	138.64014	96.96068	0.63002	0.16258	2	251.32208	7.87792	6.16823	0.0804917	0.0200097	0.0067149	0.0001347	15.063987	15.9412
1239.9948	139.1232	96.94147	0.633	0.16258	2	251.27229	7.92771	6.21803	0.0811415	0.0206594	0.0069345	0.0001436	15.55749	16.42426
1240.00244	139.60627	96.92464	0.6355	0.16258	2	251.22867	7.97133	6.26165	0.0817107	0.0212287	0.0071269	0.0001517	15.990077	16.90733
1239.99845	140.08934	96.90739	0.63926	0.16258	2	251.18395	8.01605	6.30636	0.0822942	0.0218122	0.0073242	0.0001601	16.43368	17.3904
1239.99321	140.5724	96.88973	0.64276	0.16258	2	251.13818	8.06182	6.35214	0.0828915	0.0224095	0.0075263	0.0001691	16.888058	17.87346
1239.98625	141.05547	96.87365	0.64563	0.16258	2	251.09650	8.10350	6.39382	0.0834354	0.0229534	0.0077104	0.0001774	17.301988	18.35653
1239.99953	141.53854	96.85506	0.64889	0.16258	2	251.04832	8.15168	6.44200	0.0840642	0.0235822	0.0079234	0.0001873	17.780772	18.8396
1239.98422	142.0216	96.83641	0.65222	0.16259	2	250.99997	8.20003	6.49034	0.084695	0.0242130	0.0081337	0.0001976	18.261362	19.32266
1239.99641	142.50467	96.81939	0.65537	0.16258	2	250.95586	8.24414	6.53446	0.0852707	0.0247887	0.0083321	0.0002071	18.700177	19.80573
1239.9957	142.98774	96.80161	0.6586	0.16258	2	250.90977	8.29023	6.58054	0.0858721	0.0253901	0.0085036	0.0002173	19.158821	20.2888
1239.99875	143.4708	96.78448	0.66172	0.16258	2	250.86537	8.33463	6.62494	0.0864515	0.0259695	0.0087325	0.0002274	19.600922	20.77186
1239.99898	143.95387	96.76613	0.66539	0.16258	2	250.81781	8.38219	6.67251	0.0870722	0.0265901	0.0089431	0.0002385	20.074756	21.25493
1240.00356	144.43694	96.74864	0.66839	0.16258	2	250.77247	8.42753	6.71784	0.0876638	0.0271817	0.0091439	0.0002493	20.52662	21.738
1239.99356	144.92	96.731	0.67167	0.16258	2	250.72675	8.47325	6.76356	0.0882604	0.0277842	0.0093466	0.0002604	20.982594	22.22106
1239.99194	145.40307	96.71372	0.67414	0.16258	2	250.68196	8.51804	6.80835	0.0888449	0.0283629	0.0095451	0.0002716	21.429491	22.70413
1239.9959	145.88614	96.69613	0.67745	0.16258	2	250.63637	8.56363	6.85395	0.0894399	0.0289578	0.0097473	0.0002832	21.884637	23.1872
1239.99592	146.3692	96.6781	0.68109	0.16258	2	250.58964	8.61036	6.90068	0.0900497	0.0295677	0.0099547	0.0002953	22.351413	23.67026
1239.98976	146.85227	96.66098	0.68441	0.16258	2	250.54526	8.65474	6.94506	0.0906288	0.0301467	0.0101516	0.0003071	22.794858	24.15333
1239.99314	147.33534	96.64318	0.6872	0.16258	2	250.49912	8.70088	6.99119	0.0912308	0.0307488	0.0103565	0.0003195	23.256153	24.6364
1239.9982	147.8184	96.62613	0.69051	0.16258	2	250.45493	8.74507	7.03539	0.0918075	0.0313255	0.0105528	0.0003317	23.698237	25.11946
1240.00098	148.30147	96.60713	0.69321	0.16258	2	250.40568	8.79432	7.08464	0.0924502	0.0319682	0.0107717	0.0003456	24.191143	25.60253
1239.99284	148.78454	96.58871	0.69645	0.16258	2	250.35794	8.84206	7.13238	0.0930732	0.0325912	0.0109784	0.0003593	24.669265	26.0856
1240.00554	149.2676	96.57217	0.69914	0.16258	2	250.31506	8.88494	7.17525	0.0936327	0.0331506	0.0111746	0.0003718	25.09881	26.56866
1240.0032	149.75067	96.55608	0.70302	0.16258	2	250.27336	8.92664	7.21696	0.0941769	0.0336949	0.0113602	0.0003842	25.516868	27.05173
1239.99829	150.23374	96.53834	0.70601	0.16258	2	250.22738	8.97262	7.26294	0.094777	0.0342949	0.0115649	0.0003981	25.978028	27.5348
1239.9956	150.7168	96.52174	0.70921	0.16258	2	250.18435	9.01565	7.30597	0.0953384	0.0348564	0.0117565	0.0004114	26.40977	28.01786
1239.99401	151.19987	96.50498	0.71271	0.16258	2	250.14091	9.05909	7.34941	0.0959053	0.0354233	0.01195	0.00425	26.845888	28.50093
1239.99518	151.68294	96.48703	0.71501	0.16258	2	250.09438	9.10562	7.39594	0.0965125	0.0360304	0.0121574	0.0004398	27.313211	28.984
1240.00002	152.166	96.47058	0.71814	0.16258	2	250.05174	9.14826	7.43857	0.0970689	0.0365868	0.0123475	0.0004536	27.741698	29.46706
1239.99426	152.64907	96.45307	0.72161	0.16258	2	250.00636	9.19364	7.48396	0.0976611	0.0371791	0.0125499	0.0004685	28.198025	29.95013
1239.99293	153.13214	96.4349	0.72534	0.16258	2	249.95926	9.24074	7.53106	0.0982757	0.0377937	0.01276	0.0004843	28.671802	30.4332

1240.0019	153.6152	96.41929	0.72867	0.16258	2	249.91880	9.28120	7.57152	0.0988037	0.03832171	0.0129406	0.000498	29.07903	30.91626
1240.00364	154.09827	96.40166	0.73162	0.16258	2	249.87310	9.32690	7.61721	0.0994	0.03891803	0.0131447	0.0005138	29.539181	31.39933
1239.99873	154.58134	96.38517	0.73516	0.16258	2	249.83036	9.36964	7.65996	0.0999578	0.03947578	0.0133356	0.0005288	29.969795	31.8824
1239.99731	155.0644	96.36758	0.73759	0.16258	2	249.78477	9.41523	7.70555	0.1005527	0.04007075	0.0135394	0.000545	30.429365	32.36546
1240.00536	155.54747	96.34958	0.74069	0.16258	2	249.73811	9.46189	7.75221	0.1011616	0.04067958	0.013748	0.0005618	30.899895	32.84853
1240.00359	156.03054	96.33252	0.74487	0.16258	2	249.69389	9.50611	7.79642	0.1017386	0.04125662	0.0139458	0.000578	31.346084	33.3316
1240.00071	156.5136	96.31463	0.74717	0.16258	2	249.64752	9.55248	7.84280	0.1023437	0.04186173	0.0141533	0.0005953	31.814223	33.81466
1239.99391	156.99667	96.29825	0.7503	0.16258	2	249.60506	9.59494	7.88525	0.1028978	0.04241577	0.0143433	0.0006113	32.243066	34.29773
1240.0016	157.47974	96.28055	0.75384	0.16258	2	249.55919	9.64081	7.93113	0.1034965	0.04301445	0.0145488	0.0006288	32.706703	34.7808
1239.99562	157.9628	96.26327	0.75656	0.16258	2	249.51440	9.68560	7.97592	0.1040809	0.04359893	0.0147495	0.0006462	33.159572	35.26386
1239.99816	158.44587	96.24708	0.75951	0.16258	2	249.47243	9.72757	8.01789	0.1046285	0.04414654	0.0149375	0.0006627	33.584086	35.74693
1240.00426	158.92894	96.22854	0.76278	0.16258	2	249.42438	9.77562	8.06594	0.1052556	0.04477364	0.015153	0.0006819	34.070469	36.23
1239.99711	159.412	96.21132	0.76553	0.16258	2	249.37974	9.82026	8.11058	0.1058381	0.04535609	0.0153532	0.0006999	34.522462	36.71306
1240.00115	159.89507	96.19423	0.76837	0.16258	2	249.33544	9.86456	8.15487	0.1064161	0.04593414	0.015552	0.0007181	34.971272	37.19613
1239.98973	160.37814	96.1779	0.77234	0.16258	2	249.29312	9.90688	8.19720	0.1069685	0.04648649	0.015742	0.0007356	35.400336	37.6792
1239.9896	160.8612	96.16085	0.77456	0.16258	2	249.24892	9.95108	8.24139	0.1075452	0.04706319	0.0159405	0.0007542	35.848541	38.16226
1239.99733	161.34427	96.14446	0.77805	0.16258	2	249.20644	9.99356	8.28388	0.1080996	0.04761757	0.0161313	0.0007723	36.279609	38.64533
1240.00711	161.82734	96.12829	0.78099	0.16258	2	249.16453	10.03547	8.32579	0.1086465	0.0481645	0.0163197	0.0007903	36.705098	39.1284
1239.99613	162.3104	96.10891	0.78523	0.16258	2	249.11429	10.08571	8.37602	0.109302	0.04882001	0.0165456	0.0008122	37.215322	39.61146
1240.00384	162.79347	96.09245	0.78748	0.16258	2	249.07163	10.12837	8.41869	0.1098588	0.04937675	0.0167375	0.0008311	37.648902	40.09453
1240.00182	163.27654	96.07695	0.78992	0.16258	2	249.03145	10.16855	8.45886	0.110383	0.04990103	0.0169183	0.00849	38.057389	40.5776
1240.00831	163.7596	96.05992	0.79409	0.16258	2	248.98731	10.21269	8.50300	0.110959	0.05047705	0.017117	0.0008689	38.506414	41.06066
1239.9873	164.24267	96.04278	0.79798	0.16258	2	248.94289	10.25711	8.54743	0.1115388	0.05105679	0.0173171	0.0008893	38.958571	41.54373
1239.99295	164.72574	96.02728	0.80047	0.16258	2	248.90271	10.29729	8.58761	0.1120631	0.05158107	0.0174981	0.0009078	39.367663	42.0268
1239.99002	165.2088	96.00789	0.80341	0.16258	2	248.85245	10.34755	8.63787	0.1127189	0.05223691	0.0177246	0.0009313	39.87969	42.50986
1239.99096	165.69187	95.99079	0.80599	0.16258	2	248.80813	10.39187	8.68219	0.1132973	0.0528153	0.0179245	0.0009523	40.331493	42.99293
1239.99196	166.17494	95.97448	0.80911	0.16258	2	248.76585	10.43415	8.72446	0.113849	0.05336697	0.0181152	0.0009726	40.762637	43.476
1240.00105	166.658	95.95816	0.81328	0.16258	2	248.72355	10.47645	8.76677	0.114401	0.05391898	0.0183061	0.0009931	41.194256	43.95906
1240.00302	167.14107	95.93953	0.81579	0.16258	2	248.67526	10.52474	8.81506	0.1150311	0.05454912	0.0185241	0.0010167	41.687226	44.44213
1239.9989	167.62414	95.92326	0.81888	0.16258	2	248.63309	10.56691	8.85723	0.1155814	0.05509944	0.0187145	0.0010376	42.117973	44.9252
1239.99605	168.1072	95.90693	0.82229	0.16258	2	248.59076	10.60924	8.89955	0.1161338	0.05565179	0.0189058	0.0010588	42.550519	45.40826
1240.00212	168.59027	95.88979	0.82489	0.16258	2	248.54634	10.65366	8.94398	0.1167135	0.05623153	0.0191066	0.0010812	43.004748	45.89133
1240.00178	169.07334	95.87119	0.82851	0.16258	2	248.49812	10.70188	8.99219	0.1173427	0.05686066	0.0193246	0.0011059	43.497932	46.3744
1240.00	169.5564	95.85495	0.83172	0.16258	2	248.45603	10.74397	9.03429	0.1178	0.05740	0.0195	0.00112	43.928765	46.85746

139									92	996	15	76		
1240.01203	170.03947	95.83772	0.83443	0.16258	2	248.41137	10.78863	9.07895	0.1184747	0.05799275	0.0197171	0.001151	44.386091	47.34053
1240.00112	170.52254	95.81921	0.83773	0.16258	2	248.36339	10.83661	9.12692	0.1191008	0.05861883	0.0199343	0.0011763	44.877656	47.8236
1239.99286	171.00561	95.80365	0.84084	0.16258	2	248.32306	10.87694	9.16726	0.1196271	0.05914513	0.020117	0.0011978	45.291089	48.30667
1239.99782	171.48867	95.78492	0.84356	0.16258	2	248.27451	10.92549	9.21580	0.1202607	0.05977866	0.020337	0.001224	45.789006	48.78973
1240.00818	171.97174	95.76802	0.84705	0.16258	2	248.23071	10.96929	9.25961	0.1208323	0.06035028	0.0205356	0.0012478	46.238516	49.2728
1240.00401	172.45481	95.75156	0.84942	0.16258	2	248.18804	11.01196	9.30227	0.121389	0.06090703	0.0207291	0.0012713	46.676541	49.75587
1240.00548	172.93787	95.73387	0.85281	0.16258	2	248.14219	11.05781	9.34813	0.1219874	0.06150537	0.0209371	0.0012967	47.147541	50.23893
1239.99544	173.42094	95.71814	0.85545	0.16258	2	248.10142	11.09858	9.38890	0.1225194	0.06203743	0.0211221	0.0013196	47.566566	50.722
1239.99463	173.90401	95.69872	0.85935	0.16258	2	248.05108	11.14892	9.43923	0.1231763	0.06269429	0.0213507	0.0013481	48.084161	51.20507
1239.99001	174.38707	95.68265	0.86178	0.16258	2	248.00943	11.19057	9.48089	0.1237198	0.06323784	0.0215399	0.0013719	48.512698	51.68813
1239.9957	174.87014	95.6663	0.86641	0.16258	2	247.96705	11.23295	9.52327	0.1242729	0.06379086	0.0217325	0.0013964	48.948915	52.1712
1239.99798	175.35321	95.64988	0.86875	0.16258	2	247.92449	11.27551	9.56583	0.1248283	0.06434625	0.021926	0.0014212	49.387216	52.65427
1239.99861	175.83627	95.63188	0.87208	0.16258	2	247.87783	11.32217	9.61248	0.1254371	0.06495509	0.0221382	0.0014486	49.867942	53.13733
1240.00448	176.31934	95.61419	0.87621	0.16258	2	247.83198	11.36802	9.65834	0.1260354	0.06555343	0.0223468	0.0014758	50.340643	53.6204
1240.00064	176.80241	95.59692	0.87902	0.16258	2	247.78722	11.41278	9.70310	0.1266196	0.06613757	0.0225506	0.0015026	50.802365	54.10347
1239.99271	177.28547	95.57842	0.88266	0.16258	2	247.73926	11.46074	9.75105	0.1272453	0.06676332	0.0227689	0.0015317	51.297238	54.58653
1239.99677	177.76854	95.56235	0.88604	0.16258	2	247.69761	11.50239	9.79271	0.1277889	0.06730687	0.0229587	0.0015571	51.727334	55.0696
1239.99895	178.25161	95.54581	0.88927	0.16258	2	247.65474	11.54526	9.83558	0.1283483	0.06786632	0.0231541	0.0015835	52.170227	55.55267
1239.99825	178.73467	95.52777	0.89204	0.16258	2	247.60798	11.59202	9.88234	0.1289585	0.06847651	0.0233673	0.0016126	52.653538	56.03573
1240.00317	179.21774	95.51025	0.89566	0.16258	2	247.56257	11.63743	9.92775	0.1295511	0.0690691	0.0235744	0.0016411	53.123171	56.5188
1240.00661	179.70081	95.49369	0.89805	0.16258	2	247.51964	11.68036	9.97067	0.1301112	0.06962923	0.0237703	0.0016682	53.567299	57.00187
1239.99953	180.18387	95.47495	0.90126	0.16258	2	247.47107	11.72893	10.01925	0.1307451	0.07026309	0.023992	0.0016992	54.070162	57.48493
1239.99773	180.66694	95.4572	0.90435	0.16258	2	247.42506	11.77494	10.06525	0.1313455	0.07086347	0.0242022	0.0017289	54.546723	57.968
1240.0018	181.15001	95.43938	0.90742	0.16258	2	247.37887	11.82113	10.11144	0.1319482	0.07146621	0.0244132	0.0017589	55.025422	58.45107
1239.99928	181.63307	95.42258	0.91059	0.16258	2	247.33533	11.86467	10.15499	0.1325165	0.07203446	0.0246123	0.0017875	55.476957	58.93413
1240.00547	182.11614	95.40604	0.91385	0.16258	2	247.29246	11.90754	10.19786	0.1330759	0.07259391	0.0248083	0.0018158	55.921729	59.4172
1240.00935	182.59921	95.38803	0.91692	0.16258	2	247.24577	11.95423	10.24454	0.1336851	0.07320308	0.0250219	0.001847	56.406285	59.90027
1240.00331	183.08227	95.37019	0.91967	0.16258	2	247.19953	12.00047	10.29078	0.1342885	0.0738065	0.0252335	0.0018781	56.886528	60.38333
1239.99852	183.56534	95.35243	0.92272	0.16258	2	247.15350	12.04650	10.33682	0.1348892	0.07440721	0.0254443	0.0019093	57.364877	60.8664
1240.00485	184.04841	95.33559	0.92607	0.16258	2	247.10985	12.09015	10.38047	0.1354588	0.07497681	0.0256443	0.0019392	57.818684	61.34947
1239.99338	184.53147	95.31926	0.92952	0.16258	2	247.06752	12.13248	10.42279	0.1360112	0.07552915	0.0258383	0.0019683	58.258971	61.83253
1239.99053	185.01454	95.30175	0.93259	0.16258	2	247.02214	12.17786	10.46818	0.1366034	0.07612141	0.0260463	0.0019999	58.731315	62.3156
1239.99415	185.49761	95.28455	0.93544	0.16258	2	246.97755	12.22245	10.51276	0.1371852	0.07670319	0.0262508	0.0020311	59.195542	62.79867

1240.0106	185.98067	95.26843	0.93831	0.16258	2	246.93577	12.26423	10.55455	0.1377304	0.07724843	0.0264425	0.0020606	59.630841	63.28173
1240.00385	186.46374	95.24992	0.94157	0.16258	2	246.88779	12.31221	10.60252	0.1383565	0.07787451	0.0266628	0.0020948	60.130942	63.7648
1240.00309	186.94681	95.23258	0.94461	0.16258	2	246.84285	12.35715	10.64747	0.138943	0.07846102	0.0268692	0.0021271	60.599689	64.24787
1239.99892	187.42987	95.21428	0.94792	0.16258	2	246.79541	12.40459	10.69490	0.139562	0.07908	0.0270871	0.0021614	61.094656	64.73093
1239.99491	187.91294	95.19832	0.95055	0.16258	2	246.75405	12.44595	10.73627	0.1401018	0.07961983	0.0272772	0.0021916	61.526558	65.214
1240.01105	188.39601	95.18169	0.95357	0.16258	2	246.71094	12.48906	10.77938	0.1406643	0.08018233	0.0274754	0.0022232	61.976815	65.69707
1240.00149	188.87907	95.16302	0.95734	0.16258	2	246.66255	12.53745	10.82777	0.1412958	0.08081382	0.027698	0.002259	62.482578	66.18013
1240.00073	189.36214	95.14456	0.96005	0.16258	2	246.61470	12.58530	10.87562	0.1419202	0.08143821	0.0279182	0.0022948	62.982936	66.6632
1240.00347	189.84521	95.12772	0.9631	0.16258	2	246.57105	12.62895	10.91927	0.1424898	0.08200781	0.0281192	0.0023276	63.43963	67.14627
1239.99778	190.32827	95.10968	0.96651	0.16258	2	246.52429	12.67571	10.96603	0.1431	0.08261799	0.0283346	0.0023631	63.929129	67.62933
1239.98978	190.81134	95.09263	0.96943	0.16258	2	246.48010	12.71990	11.01022	0.1436767	0.08319469	0.0285382	0.0023968	64.392014	68.1124
1239.9946	191.29441	95.07345	0.97221	0.16258	2	246.43038	12.76962	11.05993	0.1443254	0.08384344	0.0287674	0.0024351	64.913014	68.59547
1240.0063	191.77747	95.05697	0.97629	0.16258	2	246.38767	12.81233	11.10265	0.1448829	0.08440086	0.0289645	0.0024682	65.360917	69.07853
1240.00709	192.26054	95.04062	0.97958	0.16258	2	246.34529	12.85471	11.14503	0.1454359	0.08495388	0.02916	0.0025013	65.80551	69.5616
1240.00245	192.74361	95.02253	0.98208	0.16258	2	246.29840	12.90160	11.19192	0.1460478	0.08556576	0.0293764	0.0025382	66.297678	70.04467
1240.00788	193.22667	95.00357	0.98563	0.16258	2	246.24925	12.95075	11.24106	0.1466891	0.08620706	0.0296034	0.0025772	66.813809	70.52773
1240.00026	193.70974	94.98525	0.98872	0.16258	2	246.20177	12.99823	11.28855	0.1473087	0.08682672	0.0298228	0.0026151	67.312804	71.0108
1239.99878	194.19281	94.96632	0.99182	0.16258	2	246.15270	13.04730	11.33762	0.147949	0.08746701	0.0300496	0.0026547	67.828708	71.49387
1240.00125	194.67587	94.94993	0.99533	0.16258	2	246.11022	13.08978	11.38010	0.1485034	0.08802138	0.0302461	0.0026891	68.275632	71.97693
1239.99882	195.15894	94.93113	0.99774	0.16258	2	246.06149	13.13851	11.42883	0.1491393	0.08865727	0.0304715	0.002729	68.788549	72.46
1239.99902	195.64201	94.91288	1.00153	0.16258	2	246.01418	13.18582	11.47613	0.1497566	0.08927456	0.0306905	0.0027679	69.286745	72.94307
1240.00108	196.12507	94.89772	1.00513	0.16258	2	245.97489	13.22511	11.51543	0.1502693	0.08978734	0.0308724	0.0028005	69.700801	73.42613
1239.99644	196.60814	94.8789	1.00785	0.16258	2	245.92611	13.27389	11.56421	0.1509059	0.0904239	0.0310984	0.0028412	70.21509	73.9092
1239.99237	197.09121	94.86098	1.0113	0.16258	2	245.87966	13.32034	11.61066	0.151512	0.09103003	0.0313137	0.0028802	70.705062	74.39227
1239.99658	197.57427	94.8438	1.01449	0.16258	2	245.83513	13.36487	11.65519	0.1520931	0.09161113	0.0315201	0.0029179	71.175056	74.87533
1240.00105	198.05734	94.8255	1.01742	0.16258	2	245.78770	13.41230	11.70262	0.1527121	0.09223011	0.0317401	0.0029584	71.675963	75.3584
1240.00078	198.54041	94.80682	1.02048	0.16258	2	245.73928	13.46072	11.75104	0.1533439	0.09286194	0.0319648	0.0029999	72.187563	75.84147
1240.00762	199.02347	94.78819	1.02391	0.16258	2	245.69099	13.50901	11.79933	0.1539741	0.09349208	0.032189	0.0030417	72.698088	76.32453
1240.00139	199.50654	94.76955	1.02679	0.16258	2	245.64267	13.55733	11.84764	0.1546046	0.09412256	0.0324135	0.0030838	73.209181	76.8076
1239.99381	199.98961	94.75092	1.02963	0.16258	2	245.59438	13.60562	11.89593	0.1552347	0.0947527	0.0326379	0.0031262	73.720294	77.29067
1240.00311	200.47267	94.73228	1.03318	0.16258	2	245.54607	13.65393	11.94425	0.1558652	0.09538318	0.0328625	0.0031689	74.231977	77.77373
1239.99736	200.95574	94.71364	1.03686	0.16258	2	245.49775	13.70225	11.99256	0.1564957	0.09601366	0.0330872	0.0032119	74.743955	78.2568
1239.99409	201.43881	94.69503	1.03876	0.16258	2	245.44952	13.75048	12.04080	0.1571251	0.09664313	0.0333117	0.0032551	75.255403	78.73987
1240.00	201.92187	94.67629	1.04202	0.16258	2	245.40094	13.79906	12.08937	0.1577	0.09727	0.0335	0.00329	75.770722	79.22293

749									59	699	379	89		
1240.01184	202.40494	94.65812	1.04608	0.16258	2	245.35385	13.84615	12.13647	0.1583736	0.09789157	0.0337573	0.0033417	76.270654	79.706
1240.00363	202.88801	94.6398	1.04941	0.16258	2	245.30636	13.89364	12.18396	0.1589932	0.09851123	0.0339785	0.0033852	76.774997	80.18907
1240.0118	203.37107	94.6192	1.05238	0.16258	2	245.25297	13.94703	12.23735	0.15969	0.099208	0.0342275	0.0034344	77.342451	80.67213
1240.01029	203.85414	94.59934	1.05516	0.16258	2	245.20149	13.99851	12.28883	0.1603617	0.09987975	0.0344676	0.0034822	77.889864	81.1552
1239.99548	204.33721	94.58067	1.05844	0.16258	2	245.15310	14.04690	12.33722	0.1609932	0.10051124	0.0346935	0.0035274	78.404784	81.63827
1239.99493	204.82027	94.56073	1.06168	0.16258	2	245.10141	14.09859	12.38890	0.1616677	0.1011857	0.0349348	0.003576	78.955062	82.12133
1240.00289	205.30334	94.54314	1.06454	0.16258	2	245.05582	14.14418	12.43450	0.1622627	0.10178066	0.0351478	0.0036193	79.44077	82.6044
1239.99451	205.78641	94.52345	1.06766	0.16258	2	245.00478	14.19522	12.48553	0.1629287	0.10244665	0.0353863	0.003668	79.984781	83.08747
1240.00216	206.26947	94.50314	1.07035	0.16258	2	244.95214	14.24786	12.53818	0.1636156	0.10313362	0.0356325	0.0037185	80.546271	83.57053
1240.00771	206.75254	94.4863	1.07381	0.16258	2	244.90849	14.29151	12.58183	0.1641852	0.10370322	0.0358367	0.0037608	81.012099	84.0536
1239.99187	207.23561	94.46573	1.0772	0.16258	2	244.85517	14.34483	12.63514	0.164881	0.10439898	0.0360862	0.0038127	81.581438	84.53667
1240.00371	207.71867	94.44597	1.08053	0.16258	2	244.80395	14.39605	12.68636	0.1655493	0.10506734	0.0363261	0.0038629	82.128702	85.01973
1240.00104	208.20174	94.42774	1.08413	0.16258	2	244.75670	14.44330	12.73361	0.166166	0.10568395	0.0365474	0.0039095	82.633891	85.5028
1239.9937	208.68481	94.40782	1.08716	0.16258	2	244.70507	14.49493	12.78525	0.1668397	0.10635773	0.0367894	0.0039608	83.186242	85.98587
1240.00504	209.16787	94.38971	1.09038	0.16258	2	244.65813	14.54187	12.83219	0.1674523	0.10697028	0.0370096	0.0040077	83.688703	86.46893
1240.00514	209.65094	94.37011	1.09433	0.16258	2	244.60733	14.59267	12.88299	0.1681152	0.10763323	0.0372479	0.0040589	84.232825	86.952
1239.99772	210.13401	94.34914	1.09723	0.16258	2	244.55297	14.64703	12.93735	0.1688245	0.10834252	0.0375031	0.0041139	84.815348	87.43507
1239.99981	210.61707	94.33001	1.10062	0.16258	2	244.50339	14.69661	12.98693	0.1694716	0.10898958	0.0377359	0.0041645	85.347092	87.91813
1239.99334	211.10014	94.31154	1.10457	0.16258	2	244.45551	14.74449	13.03481	0.1700963	0.1096143	0.0379609	0.0042137	85.860793	88.4012
1239.99419	211.58321	94.29245	1.10695	0.16258	2	244.40603	14.79397	13.08429	0.170742	0.11026001	0.0381935	0.0042648	86.39205	88.88427
1240.00297	212.06627	94.2726	1.11012	0.16258	2	244.35458	14.84542	13.13574	0.1714134	0.11093141	0.0384355	0.0043183	86.944795	89.36733
1240.00516	212.54934	94.25179	1.11373	0.16258	2	244.30064	14.89936	13.18968	0.1721173	0.11163529	0.0386893	0.0043748	87.524641	89.8504
1240.00272	213.03241	94.23127	1.11733	0.16258	2	244.24745	14.95255	13.24286	0.1728114	0.11232936	0.0389397	0.0044308	88.096778	90.33347
1239.99915	213.51547	94.21115	1.12091	0.16258	2	244.19530	15.00470	13.29502	0.1734919	0.1130099	0.0391854	0.0044862	88.65812	90.81653
1240.00108	213.99854	94.19094	1.12435	0.16258	2	244.14292	15.05708	13.34740	0.1741755	0.11369348	0.0394323	0.0045421	89.22233	91.2996
1240.01173	214.48161	94.17077	1.12722	0.16258	2	244.09064	15.10936	13.39968	0.1748577	0.11437571	0.0396788	0.0045983	89.785781	91.78267
1240.01471	214.96467	94.15053	1.13075	0.16258	2	244.03817	15.16183	13.45214	0.1755423	0.11506031	0.0399263	0.004655	90.351547	92.26573
1240.00029	215.44774	94.1305	1.13358	0.16258	2	243.98626	15.21374	13.50406	0.1762198	0.11573781	0.0401714	0.0047116	90.911798	92.7488
1240.00022	215.93081	94.1095	1.13675	0.16258	2	243.93182	15.26818	13.55849	0.1769301	0.11644811	0.0404285	0.0047712	91.49956	93.23187
1240.00262	216.41387	94.09022	1.14057	0.16258	2	243.88185	15.31815	13.60847	0.1775822	0.11710024	0.0406646	0.0048263	92.039524	93.71493
1239.98891	216.89694	94.07077	1.14349	0.16258	2	243.83144	15.36856	13.65888	0.1782401	0.11775812	0.0409029	0.0048823	92.584582	94.198
1240.00024	217.38001	94.04985	1.14685	0.16258	2	243.77721	15.42279	13.71311	0.1789477	0.11846571	0.0411594	0.0049428	93.171208	94.68107
1240.00531	217.86307	94.02899	1.15034	0.16258	2	243.72314	15.47686	13.76717	0.1796533	0.11917128	0.0414153	0.0050036	93.756537	95.16413

1239.99195	218.34614	94.00731	1.15431	0.16258	2	243.66695	15.53305	13.82337	0.1803866	0.11990459	0.0416814	0.00506 72	94.365285	95.6472
1240.0102	218.82921	93.98664	1.15751	0.16258	2	243.61337	15.58663	13.87695	0.1810857	0.12060373	0.0419352	0.00512 82	94.946061	96.13027
1240.01097	219.31227	93.96658	1.16157	0.16258	2	243.56138	15.63862	13.92894	0.1817642	0.12128224	0.0421817	0.00518 78	95.510061	96.61333
1239.99391	219.79534	93.94631	1.16448	0.16258	2	243.50884	15.69116	13.98148	0.1824499	0.12196785	0.0424309	0.00524 84	96.080329	97.0964
1239.99926	220.27841	93.92602	1.16695	0.16258	2	243.45624	15.74376	14.03407	0.1831361	0.12265414	0.0426804	0.00530 94	96.651527	97.57947
1239.99142	220.76147	93.90206	1.17112	0.16258	2	243.39414	15.80586	14.09618	0.1839466	0.12346457	0.0429753	0.00538 19	97.326514	98.06253
1240.00117	221.24454	93.88218	1.17402	0.16258	2	243.34261	15.85739	14.14771	0.184619	0.12413699	0.0432201	0.00544 25	97.886951	98.5456
1240.0083	221.72761	93.86213	1.17748	0.16258	2	243.29064	15.90936	14.19968	0.1852972	0.12481516	0.0434671	0.00550 39	98.452539	99.02867
1239.99454	222.21067	93.84087	1.18143	0.16258	2	243.23554	15.96446	14.25478	0.1860163	0.12553426	0.0437291	0.00556 95	99.052653	99.51173
1239.98151	222.69374	93.82024	1.18399	0.16259	2	243.18206	16.01794	14.30825	0.1867141	0.12623205	0.0439835	0.00563 35	99.635372	99.9948
1239.99982	223.17681	93.79722	1.18632	0.16258	2	243.12239	16.07761	14.36792	0.1874927	0.12701068	0.0442676	0.00570 54	100.28605	100.47787
1239.99693	223.65987	93.77523	1.19011	0.16258	2	243.06540	16.13460	14.42492	0.1882365	0.12775447	0.0445391	0.00577 45	100.90806	100.96093
1240.00691	224.14294	93.75219	1.19377	0.16258	2	243.00568	16.19432	14.48464	0.1890158	0.12853378	0.0448237	0.00584 74	101.56024	101.444
1240.0013	224.62601	93.73012	1.19794	0.16258	2	242.94847	16.25153	14.54185	0.1897623	0.12928027	0.0450966	0.00591 77	102.1854	101.92707
1240.00074	225.10907	93.70784	1.20118	0.16258	2	242.89072	16.30928	14.59960	0.1905159	0.13003387	0.0453721	0.00598 91	102.81697	102.41013
1239.99638	225.59214	93.68525	1.20353	0.16258	2	242.83217	16.36783	14.65815	0.19128	0.13079796	0.0456517	0.00606 19	103.45778	102.8932
1240.00843	226.07521	93.66279	1.2068	0.16258	2	242.77395	16.42605	14.71637	0.1920396	0.13155764	0.0459298	0.00613 49	104.09536	103.37627
1239.9946	226.55827	93.63973	1.20999	0.16258	2	242.71418	16.48582	14.77614	0.1928196	0.13233763	0.0462155	0.00621 02	104.75045	103.85933
1239.99892	227.04134	93.61559	1.21343	0.16258	2	242.65161	16.54839	14.83871	0.1936361	0.13315414	0.0465148	0.00628 96	105.43673	104.3424
1240.00817	227.52441	93.59331	1.21655	0.16258	2	242.59386	16.60614	14.89646	0.1943897	0.13390774	0.0467912	0.00636 34	106.07061	104.82547
1240.00434	228.00747	93.57267	1.22036	0.16258	2	242.54036	16.65964	14.94996	0.1950879	0.13460586	0.0470474	0.00643 21	106.65823	105.30853
1240.00622	228.49054	93.54825	1.22369	0.16258	2	242.47706	16.72294	15.01325	0.1959138	0.13543185	0.0473506	0.00651 39	107.35397	105.7916
1239.99906	228.97361	93.52462	1.22748	0.16258	2	242.41582	16.78418	15.07450	0.1967131	0.13623111	0.0476443	0.00659 36	108.02773	106.27467
1240.00124	229.45667	93.50135	1.23048	0.16258	2	242.35550	16.84450	15.13482	0.1975002	0.13701819	0.0479337	0.00667 26	108.69171	106.75773
1240.01075	229.93974	93.47874	1.23418	0.16258	2	242.29689	16.90311	15.19342	0.198265	0.13778296	0.048215	0.00674 99	109.33734	107.2408
1239.99597	230.42281	93.45615	1.23793	0.16258	2	242.23834	16.96166	15.25198	0.199029	0.13854704	0.0484962	0.00682 75	109.98287	107.72387
1240.00474	230.90587	93.43397	1.24168	0.16258	2	242.18085	17.01915	15.30947	0.1997793	0.13929726	0.0487725	0.00690 42	110.61714	108.20693
1240.00228	231.38894	93.4077	1.24502	0.16258	2	242.11276	17.08724	15.37756	0.2006678	0.14018582	0.0491	0.00699 57	111.36895	108.69
1240.0076	231.87201	93.3853	1.2481	0.16258	2	242.05470	17.14530	15.43562	0.2014255	0.14094347	0.0493793	0.00707 42	112.01051	109.17307
1240.00288	232.35507	93.36398	1.25139	0.16258	2	241.99944	17.20056	15.49088	0.2021466	0.1416646	0.0496454	0.00714 93	112.62157	109.65613
1239.99915	232.83814	93.33907	1.25487	0.16258	2	241.93487	17.26513	15.55545	0.2029892	0.14250716	0.0499565	0.00723 76	113.33605	110.1392
1239.99661	233.32121	93.31796	1.25867	0.16258	2	241.88015	17.31985	15.61016	0.2037032	0.14322118	0.0502202	0.00731 29	113.94199	110.62227
1239.99155	233.80427	93.29344	1.26236	0.16258	2	241.81660	17.38340	15.67372	0.2045325	0.14405055	0.0505268	0.00740 09	114.64633	111.10533
1240.00	234.28734	93.2699	1.26565	0.16258	2	241.75558	17.44442	15.73474	0.2053	0.14484	0.0508	0.00748	115.32304	111.5884

307									288	677	213	59		
1240.00442	234.77041	93.24675	1.26894	0.16258	2	241.69558	17.50442	15.79474	0.2061118	0.14562979	0.0511111	0.00757	115.98904	112.07147
1240.00264	235.25347	93.22194	1.27225	0.16258	2	241.63127	17.56873	15.85905	0.206951	0.14646897	0.0514219	0.0076607	116.70336	112.55453
1240.01152	235.73654	93.19783	1.27548	0.16258	2	241.56878	17.63122	15.92154	0.2077665	0.14728446	0.0517241	0.0077494	117.39807	113.0376
1240.00789	236.21961	93.17306	1.27901	0.16258	2	241.50457	17.69543	15.98575	0.2086043	0.14812229	0.0520347	0.0078411	118.11236	113.52067
1239.99433	236.70267	93.14811	1.28293	0.16258	2	241.43990	17.76010	16.05042	0.2094482	0.14896619	0.0523479	0.007934	118.83242	114.00373
1239.99952	237.18574	93.12486	1.28553	0.16258	2	241.37964	17.82036	16.11068	0.2102346	0.1497526	0.0526399	0.0080211	119.50395	114.4868
1240.00477	237.66881	93.09924	1.28896	0.16258	2	241.31323	17.88677	16.17709	0.2111012	0.15061917	0.0529618	0.0081178	120.24451	114.96987
1240.0072	238.15187	93.0766	1.29231	0.16258	2	241.25455	17.94545	16.23577	0.211867	0.15138495	0.0532465	0.0082036	120.89945	115.45293
1239.99454	238.63494	93.05341	1.29594	0.16258	2	241.19444	18.00556	16.29588	0.2126513	0.15216933	0.0535383	0.0082921	121.5708	115.936
1239.98884	239.11801	93.02781	1.2993	0.16258	2	241.12808	18.07192	16.36223	0.2135172	0.15303523	0.0538606	0.0083904	122.31251	116.41907
1239.99697	239.60107	93.00297	1.30314	0.16258	2	241.06370	18.13630	16.42662	0.2143574	0.15387541	0.0541736	0.0084864	123.03279	116.90213
1239.98996	240.08414	92.97657	1.3066	0.16258	2	240.99527	18.20473	16.49505	0.2152504	0.15476837	0.0545064	0.008589	123.79895	117.3852
1240.00184	240.56721	92.95246	1.31003	0.16258	2	240.93278	18.26722	16.55754	0.2160659	0.15558387	0.0548106	0.0086833	124.49922	117.86827
1240.00196	241.05027	92.92763	1.31348	0.16258	2	240.86842	18.33158	16.62190	0.2169057	0.15642372	0.0551241	0.008781	125.22098	118.35133
1240.00598	241.53334	92.90123	1.31632	0.16258	2	240.79999	18.40001	16.69033	0.2177987	0.15731667	0.0554576	0.0088855	125.98903	118.8344

APPENDIX 4: Data for the reactivity of Argentine coke at 1290^{o}C.

										bouyancy				
Temp./-	Time/ min	Mass/%	DTA/(mW /mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	mg CO evolved	%R\ X	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1290.48533	129.42974	96.87726	0.58248	0.14663	2	250.81523	8.08477	6.64480	0.00000	0	0	0	0	0
1290.3931	129.92375	96.81277	0.58955	0.14666	2	250.64826	8.25174	6.81176	0.00056	0.0030519	0.0010183	3.109E-06	0.3437922	0.49401
1290.31334	130.41776	96.74853	0.59536	0.14668	2	250.48194	8.41806	6.97808	0.00273	0.01043518	0.0034906	3.647E-05	1.1801226	0.98802
1290.27472	130.91176	96.68572	0.60169	0.14669	2	250.31933	8.58067	7.14070	0.00486	0.01628475	0.005458	8.904E-05	1.8473992	1.48202
1290.21073	131.40577	96.62086	0.60755	0.14671	2	250.15141	8.74859	7.30862	0.00706	0.02172603	0.0072951	0.0001589	2.4718496	1.97603
1290.1745	131.89978	96.55536	0.61442	0.14673	2	249.98183	8.91817	7.47820	0.00928	0.02683786	0.0090272	0.000243	3.0618096	2.47004
1290.14595	132.39378	96.49248	0.61963	0.14674	2	249.81903	9.08097	7.64099	0.01141	0.03148747	0.010608	0.0003352	3.6012404	2.96404
1290.11306	132.88779	96.4282	0.62542	0.14675	2	249.65261	9.24739	7.80741	0.01358	0.03604017	0.0121607	0.00044	4.1320457	3.45805
1290.09036	133.3818	96.36558	0.63161	0.14675	2	249.49049	9.40951	7.96954	0.01570	0.04031788	0.0136241	0.0005518	4.6331672	3.95206
1290.07585	133.8758	96.30281	0.63694	0.14676	2	249.32798	9.57202	8.13205	0.01783	0.0444758	0.0150507	0.0006727	5.1224777	4.44606
1290.05919	134.36981	96.23959	0.64266	0.14676	2	249.16430	9.73570	8.29573	0.01997	0.04855103	0.0164529	0.0008032	5.6041988	4.94007
1290.04801	134.86382	96.17482	0.64812	0.14677	2	248.99661	9.90339	8.46342	0.02216	0.05262444	0.0178585	0.0009454	6.0878369	5.43408
1290.03894	135.35782	96.11347	0.65366	0.14677	2	248.83777	10.06223	8.62225	0.02424	0.05639898	0.0191646	0.0010878	6.5379058	5.92808
1290.02941	135.85183	96.05124	0.65895	0.14677	2	248.67666	10.22334	8.78336	0.02635	0.0601533	0.0204671	0.0012396	6.9874018	6.42209
1290.03096	136.34584	95.98881	0.66398	0.14677	2	248.51503	10.38497	8.94500	0.02846	0.06385173	0.0217537	0.0013991	7.4320108	6.9161
1290.02107	136.83984	95.92767	0.66928	0.14677	2	248.35674	10.54326	9.10329	0.03053	0.06741371	0.022996	0.0015621	7.8619187	7.4101
1290.00788	137.33385	95.86494	0.67385	0.14678	2	248.19433	10.70567	9.26569	0.03266	0.07101175	0.0242541	0.0017362	8.2978865	7.90411
1290.00653	137.82786	95.80288	0.67972	0.14678	2	248.03366	10.86634	9.42637	0.03476	0.0745194	0.0254837	0.0019152	8.7245636	8.39812
1289.99907	138.32186	95.73832	0.68574	0.14678	2	247.86651	11.03349	9.59351	0.03695	0.07811763	0.0267483	0.0021081	9.163972	8.89212
1289.99645	138.81587	95.67571	0.69047	0.14678	2	247.70441	11.19559	9.75561	0.03907	0.08156125	0.0279616	0.0023018	9.5861355	9.38613
1290.00198	139.30988	95.61482	0.69516	0.14678	2	247.54677	11.35323	9.91326	0.04113	0.08486977	0.0291303	0.0024963	9.9932526	9.88014
1290.00706	139.80388	95.55418	0.6999	0.14678	2	247.38977	11.51023	10.07025	0.04318	0.08812748	0.0302837	0.0026958	10.395576	10.37414
1290.00559	140.29789	95.49154	0.70531	0.14678	2	247.22760	11.67240	10.23243	0.04531	0.09145599	0.031465	0.0029078	10.808137	10.86815
1289.9976	140.7919	95.43033	0.71073	0.14678	2	247.06912	11.83088	10.39090	0.04738	0.09467432	0.03261	0.0031209	11.208515	11.36216
1289.99029	141.2859	95.37072	0.71537	0.14678	2	246.91479	11.98521	10.54523	0.04940	0.09777802	0.0337167	0.0033338	11.595982	11.85616
1289.99385	141.77991	95.31054	0.72066	0.14678	2	246.75899	12.14101	10.70104	0.05144	0.10088231	0.0348262	0.0035541	11.984868	12.35017
1290.00371	142.27392	95.2494	0.72514	0.14678	2	246.60070	12.29930	10.85933	0.05351	0.10400765	0.0359458	0.0037834	12.377756	12.84418
1289.99726	142.76792	95.18869	0.73013	0.14678	2	246.44352	12.45648	11.01651	0.05556	0.10708395	0.0370504	0.0040165	12.765823	13.33818
1289.99608	143.26193	95.12929	0.73582	0.14678	2	246.28973	12.61027	11.17029	0.05758	0.11006896	0.0381247	0.0042496	13.143656	13.83219
1290.00227	143.75594	95.06596	0.74092	0.14678	2	246.12577	12.77423	11.33425	0.05972	0.11322549	0.0392633	0.0045038	13.544581	14.3262
1289.993	144.24	95.00441	0.74659	0.14678	2	245.9664	12.93358	11.49361	0.0618	0.116268	0.0403	0.0047561	13.93246	14.8202

12	994					2			1	73	635		7	
1290.00361	144.74395	94.94554	0.75068	0.14678	2	245.81400	13.08600	11.64602	0.06380	0.11915773	0.0414104	0.0050024	14.301928	15.31421
1290.0041	145.23796	94.88518	0.75566	0.14678	2	245.65773	13.24227	11.80229	0.06584	0.12209865	0.0424784	0.0052599	14.679269	15.80822
1289.99378	145.73196	94.82235	0.76075	0.14678	2	245.49506	13.40494	11.96496	0.06797	0.12513798	0.0435847	0.0055333	15.070559	16.30222
1289.98515	146.22597	94.7581	0.7664	0.14679	2	245.32872	13.57128	12.13130	0.07015	0.12822374	0.0447105	0.0058183	15.46921	16.79623
1289.99914	146.71998	94.69843	0.77174	0.14678	2	245.17424	13.72576	12.28579	0.07217	0.13107012	0.0457513	0.006088	15.838176	17.29024
1290.00339	147.21398	94.63562	0.77651	0.14678	2	245.01162	13.88838	12.44840	0.07430	0.13404682	0.0468422	0.006377	16.225315	17.78424
1289.99456	147.70799	94.57417	0.782	0.14678	2	244.85253	14.04747	12.60750	0.07638	0.13694038	0.047905	0.0066648	16.602905	18.27825
1290.00053	148.202	94.51112	0.78674	0.14678	2	244.68929	14.21071	12.77073	0.07851	0.13989075	0.0489912	0.0069652	16.989194	18.77226
1290.0043	148.696	94.45185	0.79165	0.14678	2	244.53584	14.36416	12.92418	0.08052	0.14264766	0.0500084	0.0072524	17.351336	19.26626

APPENDIX 5: Data for the reactivity of Argentine coke 1340^{o}C.

Temp./- C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	mg CO evolved	%R/X	%R(adj)
1340.53098	133.56176	95.65665	0.53855	0.13102	2	248.611633	11.288367	9.970882	0	0
1340.41726	134.06577	95.48934	0.54414	0.13105	2	248.176795	11.723205	10.405720	0.0053669	0.00111851
1340.3314	134.56978	95.32513	0.5511	0.13108	2	247.750013	12.149987	10.832502	0.0109222	0.00281712
1340.26353	135.07378	95.15814	0.55767	0.1311	2	247.316006	12.583994	11.266509	0.0165717	0.00484368
1340.19672	135.57779	94.99253	0.56445	0.13112	2	246.885585	13.014415	11.696929	0.0221744	0.00707306
1340.15315	136.0818	94.82755	0.57272	0.13113	2	246.456802	13.443198	12.125712	0.0277558	0.00947021
1340.1332	136.5858	94.66417	0.58182	0.13114	2	246.032178	13.867822	12.550337	0.0332831	0.01199197
1340.09567	137.08981	94.5008	0.59003	0.13115	2	245.607579	14.292421	12.974936	0.03881	0.0146429
1340.06997	137.59382	94.3377	0.59842	0.13116	2	245.183682	14.716318	13.398833	0.0443278	0.01740522
1340.05225	138.09782	94.17061	0.60776	0.13116	2	244.749415	15.150585	13.833100	0.0499806	0.02034428
1340.04428	138.60183	94.00148	0.6203	0.13117	2	244.309847	15.590153	14.272668	0.0557024	0.02342267
1340.03448	139.10584	93.83155	0.63209	0.13117	2	243.868198	16.031802	14.714316	0.0614513	0.0266128
1340.03302	139.60984	93.65954	0.64279	0.13117	2	243.421144	16.478856	15.161370	0.0672706	0.02993454
1340.02629	140.11385	93.4876	0.65507	0.13117	2	242.974272	16.925728	15.608243	0.0730874	0.0333423
1340.01258	140.61786	93.31179	0.67101	0.13118	2	242.517342	17.382658	16.065173	0.0790352	0.03691195
1340.00695	141.12186	93.13327	0.68433	0.13118	2	242.053369	17.846631	16.529146	0.0850747	0.04062007
1340.01064	141.62587	92.95216	0.69925	0.13118	2	241.582664	18.317336	16.999851	0.0912018	0.04446359
1340.00164	142.12988	92.76607	0.71534	0.13118	2	241.099016	18.800984	17.483499	0.0974974	0.04849433
1340.01165	142.63388	92.57751	0.73163	0.13118	2	240.608948	19.291052	17.973566	0.1038765	0.05265901
1339.9947	143.13789	92.38658	0.7498	0.13118	2	240.112721	19.787279	18.469794	0.1103359	0.05695498
1340.00293	143.6419	92.19193	0.76766	0.13118	2	239.606826	20.293174	18.975689	0.116921	0.06141302
1339.99472	144.1459	91.9907	0.78285	0.13118	2	239.083829	20.816171	19.498686	0.1237288	0.06610162
1340.0018	144.64991	91.78779	0.79855	0.13118	2	238.556466	21.343534	20.026049	0.1305934	0.07090841
1339.99823	145.15392	91.58202	0.81412	0.13118	2	238.021670	21.878330	20.560845	0.1375548	0.07586099
1339.99609	145.65792	91.37548	0.83007	0.13118	2	237.484873	22.415127	21.097642	0.1445422	0.08090831
1339.99791	146.16193	91.16666	0.84577	0.13118	2	236.942149	22.957851	21.640366	0.1516068	0.08608633
1339.99747	146.66594	90.95274	0.86021	0.13118	2	236.386171	23.513829	22.196344	0.1588439	0.0914664
1340.00737	147.16994	90.73745	0.87581	0.13118	2	235.826633	24.073367	22.755882	0.1661273	0.0969557
1339.99509	147.67395	90.51709	0.88854	0.13118	2	235.253917	24.646083	23.328598	0.1735823	0.10264954
1339.99993	148.17796	90.29782	0.89954	0.13118	2	234.684034	25.215966	23.898481	0.1810004	0.10838852
1340.00167	148.68196	90.07594	0.91019	0.13118	2	234.107368	25.792632	24.475147	0.1885068	0.11426809
1339.99916	149.18597	89.85564	0.92077	0.13118	2	233.534808	26.365192	25.047707	0.1959597	0.12017573
1340.01264	149.68998	89.6328	0.93	0.13118	2	232.955647	26.944353	25.626868	0.2034986	0.12622045
1340.00091	150.19398	89.415	0.93868	0.13118	2	232.389585	27.510415	26.192930	0.2108669	0.13219376
1340.0064	150.69799	89.19253	0.94624	0.13118	2	231.811385	28.088615	26.771129	0.2183933	0.13836014
1340.00905	151.202	88.96789	0.9535	0.13118	2	231.227546	28.672454	27.354969	0.225993	0.14465169
1340	151.706	88.74403	0.96158	0.13118	2	230.645734	29.254266	27.936781	0.2335664	0.15098488
1340.00874	152.21001	88.52057	0.9684	0.13118	2	230.064961	29.835039	28.517553	0.2411262	0.15736849
1340.00239	152.71402	88.30138	0.97505	0.13118	2	229.495287	30.404713	29.087228	0.2485416	0.16368875
1339.99471	153.21802	88.07709	0.98142	0.13118	2	228.912357	30.987643	29.670158	0.2561295	0.17021489
1340.00413	153.72203	87.85364	0.98595	0.13118	2	228.331610	31.568390	30.250905	0.263689	0.17677452
1339.98643	154.22604	87.63196	0.99085	0.13118	2	227.755464	32.144536	30.827051	0.2711886	0.1833382
1340.00522	154.73004	87.41323	0.99472	0.13118	2	227.186985	32.713015	31.395530	0.2785885	0.18986813
1339.99799	155.23405	87.19344	0.99874	0.13118	2	226.615751	33.284249	31.966764	0.2860241	0.19648234
1339.99167	155.73806	86.97239	1.00173	0.13118	2	226.041242	33.858758	32.541273	0.2935025	0.20318669

1339.99296	156.24206	86.75509	1.00543	0.13118	2	225.476479	34.423521	33.106036	0.3008539	0.20982746
1339.99837	156.74607	86.53793	1.00898	0.13118	2	224.912080	34.987920	33.670435	0.3082006	0.21651278
1339.99763	157.25008	86.32246	1.01253	0.13118	2	224.352074	35.547926	34.230441	0.3154901	0.22319349
1339.98422	157.75408	86.10722	1.01489	0.13118	2	223.792665	36.107335	34.789850	0.3227719	0.22991346
1339.99672	158.25809	85.89106	1.01654	0.13118	2	223.230865	36.669135	35.351650	0.3300848	0.2367081
1339.99106	158.7621	85.67812	1.02019	0.13118	2	222.677434	37.222566	35.905081	0.3372887	0.24344582
1339.99931	159.2661	85.4686	1.02269	0.13118	2	222.132891	37.767109	36.449624	0.3443769	0.25011761

APPENDIX 6: Data for the reactivity of Argentine at 1390^{o}C.

											bouyancy			
Temp./-C	Time/ min	Mass/ %	DTA/(mW/ mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	mg CO evolved	%R /X	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1387.2570	136.7258	93.2274	0.9469	0.1169	1	242.6265	15.6735	14.1799	0.0000	0.0000	0.0000	0.00000000	0.0000	0.0000
1390.7423	137.2398	92.8122	1.0056	0.1158	2	242.4315	15.8685	14.3749	0.0002	0.0002	0.0001	0.00000001	0.0106	0.5140
1390.7774	137.7538	92.3465	1.1661	0.1158	2	242.4108	15.8892	14.3956	0.0004	0.0004	0.0001	0.00000006	0.0277	1.0280
1390.4393	138.2678	91.9395	1.3327	0.1159	2	242.3819	15.9181	14.4245	0.0008	0.0008	0.0003	0.00000022	0.0514	1.5420
1390.3608	138.7818	91.5014	1.3654	0.1159	2	242.3378	15.9622	14.4686	0.0014	0.0014	0.0005	0.00000065	0.0876	2.0560
1390.2660	139.2958	91.0411	1.4145	0.1160	2	242.2749	16.0251	14.5315	0.0022	0.0022	0.0007	0.00000164	0.1393	2.5700
1390.1924	139.8098	90.5301	1.4570	0.1160	2	242.1830	16.1170	14.6234	0.0034	0.0034	0.0011	0.00000391	0.2149	3.0840
1390.1456	140.3238	90.0441	1.4958	0.1160	2	242.0720	16.2280	14.7345	0.0049	0.0049	0.0016	0.00000794	0.3064	3.5981
1390.1153	140.8378	89.5616	1.5300	0.1160	2	241.9368	16.3632	14.8696	0.0066	0.0066	0.0022	0.00001476	0.4179	4.1120
1390.0872	141.3518	89.0716	1.5595	0.1160	2	241.7724	16.5276	15.0340	0.0088	0.0088	0.0029	0.00002590	0.5537	4.6261
1390.0561	141.8658	88.5935	1.5820	0.1160	2	241.5838	16.7162	15.2226	0.0113	0.0113	0.0038	0.00004252	0.7099	5.1401
1390.0418	142.3798	88.1124	1.6006	0.1160	2	241.3642	16.9358	15.4422	0.0141	0.0141	0.0047	0.00006706	0.8921	5.6541
1390.0360	142.8939	87.5932	1.6147	0.1160	2	241.0919	17.2081	15.7145	0.0177	0.0177	0.0059	0.00010530	1.1187	6.1681
1390.0286	143.4079	87.1370	1.6207	0.1160	2	240.8209	17.4791	15.9855	0.0213	0.0213	0.0071	0.00015198	1.3450	6.6821
1390.0179	143.9219	86.6259	1.6232	0.1160	2	240.4802	17.8198	16.3262	0.0257	0.0257	0.0086	0.00022289	1.6304	7.1961
1390.0219	144.4359	86.1407	1.6211	0.1160	2	240.1191	18.1809	16.6873	0.0304	0.0304	0.0103	0.00031304	1.9341	7.7101
1390.0083	144.9499	85.6671	1.6182	0.1160	2	239.7298	18.5702	17.0766	0.0355	0.0355	0.0120	0.00042760	2.2629	8.2241
1390.0151	145.4639	85.1622	1.6109	0.1160	2	239.2733	19.0267	17.5332	0.0415	0.0415	0.0140	0.00058514	2.6506	8.7381
1390.0112	145.9779	84.7387	1.6015	0.1160	2	238.8561	19.4439	17.9503	0.0470	0.0470	0.0159	0.00075110	3.0066	9.2521
1390.0124	146.4919	84.2888	1.5922	0.1160	2	238.3776	19.9224	18.4288	0.0532	0.0532	0.0181	0.00096753	3.4170	9.7661
1390.0038	147.0059	83.8302	1.5817	0.1160	2	237.8515	20.4485	18.9549	0.0601	0.0601	0.0205	0.00123799	3.8710	10.2801
1390.0100	147.5199	83.3862	1.5708	0.1160	2	237.3041	20.9959	19.5023	0.0673	0.0673	0.0229	0.00155586	4.3463	10.7941
1390.0000	148.0339	82.9456	1.5594	0.1160	2	236.7229	21.5771	20.0835	0.0749	0.0749	0.0256	0.00193446	4.8545	11.3082
1390.0090	148.5479	82.5153	1.5480	0.1160	2	236.1178	22.1822	20.6886	0.0828	0.0828	0.0284	0.00237411	5.3873	11.8222
1390.0006	149.0619	82.0868	1.5377	0.1160	2	235.4777	22.8223	21.3287	0.0912	0.0912	0.0314	0.00289028	5.9552	12.3362
1390.0119	149.5759	81.6736	1.5243	0.1160	2	234.8240	23.4760	21.9824	0.0997	0.0997	0.0344	0.00347231	6.5397	12.8502
1390.0036	150.0899	81.2531	1.5116	0.1160	2	234.1214	24.1786	22.6850	0.1089	0.1089	0.0377	0.00416046	7.1732	13.3642
1390.0071	150.6040	80.8274	1.4981	0.1160	2	233.3710	24.9290	23.4354	0.1188	0.1188	0.0413	0.00496810	7.8559	13.8782
1389.9906	151.1180	80.4675	1.4849	0.1160	2	232.7051	25.5949	24.1013	0.1275	0.1275	0.0444	0.00574845	8.4670	14.3922
1389.9916	151.6320	80.0722	1.4712	0.1160	2	231.9401	26.3599	24.8663	0.1375	0.1375	0.0481	0.00672003	9.1754	14.9062
1390.0018	152.14	79.697	1.4579	0.1160	2	231.181	27.1182	25.6246	0.147	0.1474	0.0518	0.00776	9.8845	15.4202

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1389.9932	152.6600	79.3232	1.4443	0.1160	2	230.3913	27.9087	26.4151	0.1578	0.1578	0.0556	0.0089	10.6309	15.9342
1390.0073	153.1740	78.9582	1.4295	0.1160	2	229.5889	28.7111	27.2175	0.1683	0.1683	0.0596	0.0102	11.3965	16.4482
1390.0086	153.6880	78.6018	1.4159	0.1160	2	228.7741	29.5259	28.0323	0.1789	0.1789	0.0636	0.0116	12.1820	16.9622
1390.0003	154.2020	78.2515	1.4002	0.1160	2	227.9430	30.3570	28.8634	0.1898	0.1898	0.0678	0.0132	12.9920	17.4762
1390.0094	154.7160	77.9094	1.3850	0.1160	2	227.1022	31.1978	29.7042	0.2008	0.2008	0.0720	0.0148	13.8206	17.9902
1389.9913	155.2300	77.5780	1.3704	0.1160	2	226.2597	32.0403	30.5467	0.2118	0.2118	0.0763	0.0166	14.6603	18.5042
1389.9985	155.7440	77.2530	1.3563	0.1160	2	225.4064	32.8936	31.4000	0.2230	0.2230	0.0807	0.0185	15.5206	19.0183
1390.0043	156.2580	76.9354	1.3404	0.1160	2	224.5463	33.7537	32.2601	0.2343	0.2343	0.0851	0.0205	16.3979	19.5323
1390.0001	156.7720	76.6279	1.3255	0.1160	2	223.6885	34.6115	33.1179	0.2455	0.2455	0.0896	0.0227	17.2835	20.0463
1389.9939	157.2860	76.3246	1.3099	0.1160	2	222.8182	35.4818	33.9882	0.2569	0.2569	0.0942	0.0250	18.1928	20.5603
1389.9985	157.8000	76.0316	1.2955	0.1160	2	221.9543	36.3457	34.8521	0.2682	0.2682	0.0988	0.0274	19.1066	21.0743
1390.0005	158.3141	75.7489	1.2819	0.1160	2	221.0988	37.2012	35.7076	0.2794	0.2794	0.1035	0.0299	20.0228	21.5883
1390.0010	158.8281	75.4707	1.2683	0.1160	2	220.2360	38.0640	36.5704	0.2907	0.2907	0.1082	0.0326	20.9585	22.1023
1390.0062	159.3421	75.1999	1.2538	0.1160	2	219.3755	38.9245	37.4309	0.3019	0.3019	0.1129	0.0354	21.9035	22.6163
1390.0014	159.8561	74.9380	1.2420	0.1160	2	218.5245	39.7755	38.2819	0.3131	0.3131	0.1177	0.0383	22.8502	23.1303
1390.0033	160.3701	74.6864	1.2308	0.1160	2	217.6887	40.6113	39.1177	0.3240	0.3240	0.1224	0.0413	23.7918	23.6443
1390.0011	160.8841	74.4401	1.2202	0.1160	2	216.8532	41.4468	39.9532	0.3350	0.3350	0.1271	0.0444	24.7452	24.1583
1389.9949	161.3981	74.2028	1.2111	0.1160	2	216.0324	42.2676	40.7740	0.3457	0.3457	0.1319	0.0476	25.6940	24.6723
1389.9960	161.9121	73.9716	1.2018	0.1160	2	215.2170	43.0830	41.5894	0.3564	0.3564	0.1366	0.0509	26.6487	25.1863
1389.9959	162.4261	73.7487	1.1944	0.1160	2	214.4168	43.8832	42.3896	0.3668	0.3668	0.1413	0.0543	27.5978	25.7003
1389.9980	162.9401	73.5332	1.1881	0.1160	2	213.6290	44.6710	43.1774	0.3772	0.3772	0.1460	0.0577	28.5441	26.2143
1389.9973	163.4541	73.3246	1.1821	0.1160	2	212.8543	45.4457	43.9521	0.3873	0.3873	0.1507	0.0613	29.4868	26.7284

APPENDIX 7: Data for the reactivity of Springlake anthracite.

Temp./~ C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(µ V/mW)	mg change	mg evolved	CO evolved	%R	%R
891.98845	87.22077	97.71758	6.53E-02	0.25733	253.2839674	5.91603264			
897.12061	87.73383	97.68581	6.31E-02	0.25629	253.2016195	5.99838048	0	0	0
902.24108	88.2469	97.6607	6.60E-02	0.25525	253.1365344	6.0634656	0.06508512	0.0008493	0.0008493
907.40562	88.75996	97.63426	6.83E-02	0.25419	253.0680019	6.13199808	0.1336176	0.0017436	0.0017436
912.53548	89.27302	97.6031	7.28E-02	0.25312	252.9872352	6.2127648	0.21438432	0.0027976	0.0027976
917.6638	89.78609	97.57394	7.38E-02	0.25203	252.9116525	6.28834752	0.28996704	0.0037839	0.0037839
922.79619	90.29915	97.5478	7.69E-02	0.25093	252.8438976	6.3561024	0.35772192	0.0046681	0.0046681
927.9306	90.81221	97.51687	7.89E-02	0.24982	252.763727	6.43627296	0.43789248	0.0057142	0.0057142
933.05433	91.32528	97.48902	8.15E-02	0.2487	252.6915398	6.50846016	0.51007968	0.0066562	0.0066562
938.18194	91.83834	97.45535	8.23E-02	0.24757	252.6042672	6.5957328	0.59735232	0.0077951	0.0077951
943.29992	92.3514	97.42903	8.23E-02	0.24642	252.5360458	6.66395424	0.66557376	0.0086853	0.0086853
948.43261	92.86447	97.40198	8.25E-02	0.24526	252.4659322	6.73406784	0.73568736	0.0096003	0.0096003
953.55647	93.37753	97.37589	8.26E-02	0.24408	252.3983069	6.80169312	0.80331264	0.0104827	0.0104827
958.6966	93.89059	97.34254	8.31E-02	0.24289	252.3118637	6.88813632	0.88975584	0.0116108	0.0116108
963.83313	94.40366	97.30647	8.40E-02	0.24169	252.2183702	6.98162976	0.98324928	0.0128308	0.0128308
968.96295	94.91672	97.28853	8.51E-02	0.24048	252.1718698	7.02813024	1.02974976	0.0134376	0.0134376
974.09786	95.42978	97.26081	8.52E-02	0.23925	252.1000195	7.09998048	1.1016	0.0143752	0.0143752
979.22031	95.94285	97.23593	8.44E-02	0.23802	252.0355306	7.16446944	1.16608896	0.0152168	0.0152168
984.36751	96.45591	97.20933	8.38E-02	0.23676	251.9665834	7.23341664	1.23503616	0.0161165	0.0161165
989.51559	96.96897	97.18828	8.38E-02	0.23549	251.9120218	7.28797824	1.28959776	0.0168285	0.0168285
994.66111	97.48204	97.16486	8.46E-02	0.23421	251.8513171	7.34868288	1.3503024	0.0176206	0.0176206
999.80061	97.9951	97.1435	8.41E-02	0.23293	251.795952	7.404048	1.40566752	0.0183431	0.0183431
1004.93206	98.50816	97.12273	8.34E-02	0.23163	251.7421162	7.45788384	1.45950336	0.0190456	0.0190456
1010.08035	99.02123	97.10408	8.42E-02	0.23031	251.6937754	7.50622464	1.50784416	0.0196765	0.0196765
1015.20895	99.53429	97.08108	8.38E-02	0.22899	251.6341594	7.56584064	1.56746016	0.0204544	0.0204544
1020.32667	100.04735	97.06633	8.46E-02	0.22766	251.5959274	7.60407264	1.60569216	0.0209533	0.0209533
1025.47555	100.56042	97.04859	8.32E-02	0.22631	251.5499453	7.65005472	1.65167424	0.0215533	0.0215533
1030.59602	101.07348	97.03215	8.32E-02	0.22495	251.5073328	7.6926672	1.69428672	0.0221094	0.0221094
1035.73224	101.58654	97.01466	8.20E-02	0.22358	251.4619987	7.73800128	1.7396208	0.022701	0.022701
1040.86289	102.09961	97.00077	8.20E-02	0.2222	251.4259958	7.77400416	1.77562368	0.0231708	0.0231708
1046.00614	102.61267	96.98538	8.13E-02	0.22081	251.386105	7.81389504	1.81551456	0.0236914	0.0236914
1051.12772	103.12573	96.96898	8.04E-02	0.21941	251.3435962	7.85640384	1.85802336	0.0242461	0.0242461
1056.26333	103.6388	96.95138	7.86E-02	0.218	251.297977	7.90202304	1.90364256	0.0248414	0.0248414
1061.39621	104.15186	96.93981	7.71E-02	0.21658	251.2679875	7.93201248	1.933632	0.0252327	0.0252327
1066.52524	104.66492	96.92473	7.61E-02	0.21515	251.2289002	7.97109984	1.97271936	0.0257428	0.0257428
1071.63303	105.17799	96.90818	7.39E-02	0.21371	251.1860026	8.01399744	2.01561696	0.0263026	0.0263026
1076.7838	105.69105	96.89194	7.19E-02	0.21226	251.1439085	8.05609152	2.05771104	0.0268519	0.0268519
1081.91659	106.20411	96.87871	6.99E-02	0.2108	251.1096163	8.09038368	2.0920032	0.0272994	0.0272994
1087.04525	106.71718	96.86491	6.82E-02	0.20933	251.0738467	8.12615328	2.1277728	0.0277661	0.0277661
1092.18053	107.23024	96.84874	6.64E-02	0.20785	251.0319341	8.16806592	2.16968544	0.0283131	0.0283131
1097.30827	107.7433	96.83699	6.35E-02	0.20637	251.0014781	8.19852192	2.20014144	0.0287105	0.0287105
1102.43875	108.25637	96.81552	6.23E-02	0.20487	250.9458278	8.25417216	2.25579168	0.0294367	0.0294367
1107.58304	108.76943	96.80326	6.00E-02	0.20337	250.9140499	8.28595008	2.2875696	0.0298514	0.0298514
1112.70183	109.28249	96.7877	5.81E-02	0.20186	250.8737184	8.3262816	2.32790112	0.0303777	0.0303777
1117.83412	109.79556	96.77273	5.65E-02	0.20034	250.8349162	8.36508384	2.36670336	0.030884	0.030884

1122.97624	110.30862	96.75772	5.38E-02	0.19881	250.7960102	8.40398976	2.40560928	0.0313917	0.0313917
1128.09908	110.82168	96.73835	5.14E-02	0.19728	250.7458032	8.4541968	2.45581632	0.0320469	0.0320469
1133.23675	111.33475	96.72217	4.83E-02	0.19574	250.7038646	8.49613536	2.49775488	0.0325942	0.0325942
1138.41143	111.84781	96.70218	6.84E-02	0.19418	250.6520506	8.54794944	2.54956896	0.0332703	0.0332703
1143.51324	112.36087	96.6844	6.89E-02	0.19263	250.6059648	8.5940352	2.59565472	0.0338717	0.0338717

APPENDIX 8: Data for the reactivity of Springlake anthracite at 1190°C.

Temp./°C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	mg CO evolved	%R/X	%R(adj)/X (bouyancy)	If(X)	Pf(X)	ti(model)	ti(exp)
1190.24758	122.99213	96.16029	0.63952	0.17823	2	248.95899	9.94101	3.81349	0	0	0	0	0	0
1190.20877	123.46518	96.14398	0.64518	0.17825	2	248.91676	9.98324	3.85572	0.0372405	0.00014753	4.91802E-05	7.25585E-09	0.2577845	0.47305
1190.17482	123.93823	96.12731	0.65049	0.17825	2	248.87361	10.02639	3.89888	0.0376574	0.00056438	0.00018816	1.06202E-07	0.9882078	0.9461
1190.14703	124.41127	96.11248	0.65591	0.17826	2	248.83521	10.06479	3.93727	0.0380282	0.00093522	0.00031184	2.91666E-07	1.6405748	1.41914
1190.12788	124.88432	96.10052	0.66101	0.17827	2	248.80425	10.09575	3.96824	0.0383273	0.00123429	0.00041159	5.08103E-07	2.1684525	1.89219
1190.11175	125.35737	96.08725	0.66584	0.17827	2	248.76989	10.13011	4.00259	0.0386591	0.00156612	0.00052231	8.18145E-07	2.7559907	2.36524
1190.08487	125.83041	96.07273	0.67115	0.17828	2	248.73230	10.16770	4.04019	0.0390222	0.00192932	0.00064348	1.24167E-06	3.4010933	2.83828
1190.06946	126.30346	96.05825	0.67641	0.17829	2	248.69481	10.20519	4.07768	0.0393843	0.00229129	0.00076435	1.75179E-06	4.0467301	3.31133
1190.06693	126.77651	96.04527	0.68088	0.17829	2	248.66120	10.23880	4.11128	0.0397089	0.00261587	0.00087271	2.28357E-06	4.6274473	3.78438
1190.05067	127.24955	96.03168	0.68578	0.17829	2	248.62602	10.27398	4.14646	0.0400487	0.00295577	0.00098620	2.91588E-06	5.2374449	4.25742
1190.03697	127.7226	96.01876	0.69032	0.1783	2	248.59257	10.30743	4.17991	0.0403718	0.00327877	0.00109412	3.58868E-06	5.8192569	4.73047
1190.02903	128.19565	96.00623	0.69526	0.1783	2	248.56013	10.33987	4.21235	0.0406851	0.00359201	0.00119880	4.30793E-06	6.3852648	5.20352
1190.0111	128.66869	95.99499	0.70022	0.17831	2	248.53103	10.36897	4.24146	0.0409662	0.00387316	0.00129272	5.00909E-06	6.8944743	5.67656
1190.01638	129.14174	95.98346	0.70467	0.1783	2	248.50118	10.39882	4.27131	0.0412545	0.00416148	0.00138908	5.78334E-06	7.4182707	6.14961
1190.01659	129.61479	95.97071	0.71049	0.1783	2	248.46817	10.43183	4.30432	0.0415733	0.00448031	0.00149567	6.7044E-06	7.9991996	6.62266
1189.99347	130.08783	95.95736	0.71715	0.17831	2	248.43361	10.46639	4.33888	0.0419071	0.00481413	0.00160729	7.74187E-06	8.6093908	7.0957
1190.00332	130.56088	95.94485	0.72103	0.17831	2	248.40122	10.49878	4.37127	0.04222	0.00512696	0.00171915	8.78192E-06	9.1829756	7.56875
1190.00663	131.03393	95.93165	0.72502	0.17831	2	248.36704	10.53296	4.40544	0.04255	0.00545704	0.00182233	9.95057E-06	9.790073	8.0418
1189.9968	131.50697	95.921	0.73033	0.17831	2	248.33947	10.56053	4.43302	0.0428163	0.00572335	0.00191143	1.09468E-05	10.281295	8.51484
1189.99912	131.98002	95.90876	0.73582	0.17831	2	248.30778	10.59222	4.46470	0.0431224	0.00602942	0.00201386	1.21506E-05	10.847404	8.98789
1190.00002	132.45307	95.89862	0.74002	0.17831	2	248.28153	10.61847	4.49096	0.0433676	0.00628298	0.00209872	1.31955E-05	11.317643	9.46094
1189.99371	132.92611	95.88924	0.7454	0.17831	2	248.25724	10.64276	4.51524	0.0436105	0.00651754	0.00217724	1.42006E-05	11.753651	9.93398
1190.00095	133.39916	95.87762	0.75088	0.17831	2	248.22716	10.67284	4.54533	0.0439011	0.00680811	0.00227453	1.5497E-05	12.295132	10.40703
1190.00759	133.87221	95.86623	0.75664	0.17831	2	248.19767	10.70233	4.57481	0.0441859	0.00709292	0.00236991	1.68229E-05	12.827347	10.88008
1189.99817	134.34525	95.85488	0.76209	0.17831	2	248.16828	10.73172	4.60420	0.0444697	0.00737674	0.00246498	1.81985E-05	13.359123	11.35312
1189.9968	134.8183	95.84428	0.76694	0.17831	2	248.14084	10.75916	4.63164	0.0447348	0.00764178	0.00255378	1.95321E-05	13.857051	11.82617
1189.99367	135.29135	95.83357	0.7716	0.17831	2	248.11311	10.78689	4.65937	0.0450026	0.00790961	0.00264352	2.09276E-05	14.361411	12.29922
1189.99199	135.76439	95.82303	0.77621	0.17831	2	248.08582	10.81418	4.68666	0.0452662	0.00817318	0.00273184	2.23482E-05	14.859009	12.77226
1189.99299	136.23744	95.81392	0.78073	0.17831	2	248.06224	10.83776	4.71025	0.045494	0.00840098	0.00280820	2.36138E-05	15.290089	13.24531
1189.98974	136.71049	95.80307	0.78476	0.17831	2	248.03415	10.86585	4.73834	0.0457653	0.00867229	0.00289916	2.51667E-05	15.804708	13.71836
1189.9	137.18	95.79013	0.79054	0.17831	2	248.0006	10.89935	4.77184	0.0460	0.008995	0.003007	2.70836E	16.420166	14.1914

8472	353					5			889	87	66	-05		
1189.98646	137.65658	95.77958	0.79564	0.17831	2	247.97333	10.92667	4.79915	0.0463527	0.00925968	0.00309613	2.86988E-05	16.923328	14.66445
1190.00496	138.12963	95.77043	0.80083	0.17831	2	247.94964	10.95036	4.82284	0.0465815	0.00948849	0.00317288	3.01377E-05	17.360721	15.1375
1189.98597	138.60267	95.759	0.80662	0.17831	2	247.92005	10.97995	4.85243	0.0468673	0.009774 3	0.00326877	3.19848E-05	17.908412	15.61054
1190.00463	139.07572	95.74757	0.81132	0.17831	2	247.89046	11.00954	4.88203	0.0471531	0.01006012	0.00336468	3.38871E-05	18.457556	16.08359
1190.01139	139.54877	95.73763	0.81634	0.17831	2	247.86472	11.03528	4.90776	0.0474017	0.01030868	0.00344810 2	3.55862E-05	18.936297	16.55664
1189.99231	140.02181	95.72856	0.82141	0.17831	2	247.84124	11.05876	4.93124	0.0476285	0.01053548	0.00352423 3	3.71731E-05	19.374096	17.02968
1189.99611	140.49486	95.71712	0.82644	0.17831	2	247.81162	11.08838	4.96086	0.0479146	0.01082155	0.00362027 4	3.92243E-05	19.927599	17.50273
1189.98669	140.96791	95.70796	0.83153	0.17831	2	247.78791	11.11209	4.98458	0.0481436	0.01105061	0.00369718 7	4.09065E-05	20.37184	17.97578
1190.00846	141.44095	95.69724	0.83568	0.17831	2	247.76015	11.13985	5.01233	0.0484117	0.01131867	0.00378721 4	4.29203E-05	20.892925	18.44882
1190.00714	141.914	95.68957	0.84092	0.17831	2	247.74030	11.15970	5.03219	0.0486035	0.01151046	0.00385163 7	4.4391E-05	21.26654	18.92187
1190.00022	142.38705	95.6786	0.84677	0.17831	2	247.71190	11.18810	5.06059	0.0488778	0.01178478	0.00394379 2	4.65378E-05	21.802043	19.39492
1189.99884	142.86009	95.66679	0.85175	0.17831	2	247.68132	11.21868	5.09116	0.0491731	0.012080 1	0.00404302 3	4.89059E-05	22.380051	19.86796
1189.99089	143.33314	95.65842	0.85682	0.17831	2	247.65965	11.24035	5.11283	0.0493824	0.01228894	0.00411336 2	5.06201E-05	22.79064	20.34101
1190.00125	143.80619	95.64759	0.86151	0.17831	2	247.63161	11.26839	5.14087	0.0496532	0.01256021	0.00420438 9	5.2882E-05	23.323065	20.81406
1190.00254	144.27923	95.64197	0.86581	0.17831	2	247.61706	11.28294	5.15542	0.0497937	0.01270074	0.00425163 2	5.40754E-05	23.599872	21.2871
1189.99189	144.75228	95.63155	0.87063	0.17831	2	247.59008	11.30992	5.18240	0.0500543	0.01296131	0.00433923 7	5.63235E-05	24.114031	21.76015
1189.98644	145.22533	95.62106	0.87613	0.17831	2	247.56292	11.33708	5.20956	0.0503166	0.01322362	0.00442744 6	5.86333E-05	24.63287	22.2332
1189.99505	145.69837	95.61183	0.88118	0.17831	2	247.53903	11.36097	5.23346	0.0505474	0.01345442	0.00450507 3	6.07042E-05	25.090407	22.70624
1190.00456	146.17142	95.60349	0.88612	0.17831	2	247.51744	11.38256	5.25505	0.050756	0.01366297	0.00457522 4	6.26065E-05	25.504645	23.17929
1189.98755	146.64447	95.59346	0.89118	0.17831	2	247.49147	11.40853	5.28102	0.0510068	0.01391378	0.00465960 5	6.49334E-05	26.003853	23.65234
1189.98848	147.11751	95.58188	0.89625	0.17831	2	247.46149	11.43851	5.31100	0.0512963	0.01420335	0.00475704 3	6.76731E-05	26.581608	24.12538

APPENDIX 9: Data for the reactivity of Springlake anthracite at 1240^0C.

										bouyancy				
Temp./−C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	CO evolved	%R	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1241.24629	122.21502	95.90075	0.3436	0.16219	2	248.2870	10.6130	4.2186	0	0	0	0	0	0
1241.39752	122.69808	95.8543	0.47848	0.16214	2	248.1668	10.7332	4.3389	0.003173	0.003173018	0.0010588	3.361E-06	1.7713536	0.48306
1241.00456	123.18115	95.80988	0.61121	0.16226	2	248.0518	10.8482	4.4539	0.0046798	0.004679766	0.0015624	7.315E-06	2.6145571	0.96613
1240.811	123.66421	95.76885	0.61599	0.16232	2	247.9456	10.9544	4.5601	0.0060715	0.006071524	0.002028	1.232E-05	3.3945884	1.44919
1240.69222	124.14727	95.72915	0.63207	0.16236	2	247.8428	11.0572	4.6629	0.0074182	0.007418168	0.0024789	1.84E-05	4.1504144	1.93225
1240.58621	124.63034	95.6905	0.64023	0.1624	2	247.7427	11.1573	4.7630	0.0087292	0.008729195	0.0029182	2.55E-05	4.8872724	2.41532
1240.49842	125.1134	95.65381	0.64566	0.16242	2	247.6477	11.2523	4.8579	0.0099737	0.009973738	0.0033357	3.331E-05	5.5876982	2.89838
1240.41858	125.59646	95.61934	0.65086	0.16245	2	247.5585	11.3415	4.9472	0.011143	0.011142977	0.0037282	4.159E-05	6.2465747	3.38144
1240.34114	126.07953	95.58588	0.65646	0.16247	2	247.4718	11.4282	5.0338	0.012278	0.012277957	0.0041095	5.053E-05	6.8869174	3.86451
1240.27517	126.56259	95.55331	0.66221	0.16249	2	247.3875	11.5125	5.1181	0.0133827	0.013382748	0.004481	6.006E-05	7.5109592	4.34757
1240.25001	127.04565	95.52109	0.667	0.1625	2	247.3041	11.5959	5.2016	0.0144757	0.014475666	0.0048487	7.03E-05	8.1290063	4.83063
1240.20374	127.52872	95.49148	0.67291	0.16252	2	247.2274	11.6726	5.2782	0.0154801	0.015480052	0.0051869	8.043E-05	8.6976131	5.3137
1240.15416	128.01178	95.46204	0.67892	0.16253	2	247.1512	11.7488	5.3544	0.0164787	0.016478671	0.0055233	9.118E-05	9.2635496	5.79676
1240.12236	128.49484	95.43206	0.68308	0.16254	2	247.0736	11.8264	5.4321	0.0174956	0.017495608	0.0058662	0.0001028	9.8404768	6.27982
1240.10609	128.97791	95.4046	0.68778	0.16255	2	247.0025	11.8975	5.5032	0.0184271	0.018427064	0.0061805	0.0001141	10.369451	6.76289
1240.0919	129.46097	95.37604	0.69331	0.16255	2	246.9286	11.9714	5.5771	0.0193958	0.019395834	0.0065075	0.0001265	10.920164	7.24595
1240.06536	129.94403	95.34736	0.6986	0.16256	2	246.8543	12.0457	5.6513	0.0203687	0.020368673	0.0068362	0.0001396	11.473756	7.72901
1240.06177	130.4271	95.31824	0.70349	0.16256	2	246.7789	12.1211	5.7267	0.0213564	0.021356438	0.0071701	0.0001535	12.03642	8.21208
1240.04929	130.91016	95.29101	0.70881	0.16256	2	246.7084	12.1916	5.7972	0.0222801	0.022280093	0.0074825	0.0001671	12.563095	8.69514
1240.03269	131.39322	95.26374	0.714	0.16257	2	246.6378	12.2622	5.8678	0.0232051	0.023205105	0.0077956	0.0001814	13.091058	9.1782
1240.02263	131.87629	95.23634	0.71964	0.16257	2	246.5669	12.3331	5.9388	0.0241345	0.024134527	0.0081104	0.0001963	13.622055	9.66127
1240.01955	132.35935	95.2108	0.72413	0.16257	2	246.5008	12.3992	6.0049	0.0250009	0.025000856	0.008404	0.0002107	14.117476	10.14433
1240.02393	132.84241	95.18347	0.72865	0.16257	2	246.4300	12.4700	6.0757	0.0259279	0.025927903	0.0087184	0.0002267	14.64812	10.62739
1240.01276	133.32548	95.15754	0.73457	0.16258	2	246.3629	12.5371	6.1428	0.0268075	0.026807462	0.0090169	0.0002424	15.152061	11.11046
1240.00025	133.80854	95.13009	0.73948	0.16258	2	246.2918	12.6082	6.2139	0.0277386	0.027738579	0.009333	0.0002597	15.686053	11.59352
1240.00475	134.2916	95.10492	0.74372	0.16258	2	246.2266	12.6734	6.2790	0.0285924	0.028592358	0.0096231	0.000276	16.176153	12.07658
1240.00366	134.77467	95.0805	0.74856	0.16258	2	246.1634	12.7366	6.3422	0.0294207	0.029420697	0.0099047	0.0002924	16.652073	12.55965
1240.00568	135.25773	95.05546	0.75423	0.16258	2	246.0986	12.8014	6.4071	0.0302701	0.030270066	0.0101936	0.0003096	17.140508	13.04271
1239.99624	135.74079	95.03142	0.75869	0.16258	2	246.0363	12.8637	6.4693	0.0310855	0.031085514	0.0104711	0.0003266	17.60985	13.52577
1239.99465	136.22386	95.00488	0.76299	0.16258	2	245.9676	12.9324	6.5380	0.0319858	0.031985764	0.0107777	0.000346	18.128471	14.00884
1239.9	136.706	94.98137	0.7684	0.16258	2	245.906	12.9932	6.5989	0.0327	0.0327832	0.0110	0.0003636	18.58829	14.491

9571	92					8			832	35	494			5	9
1239.99737	137.18998	94.95615	0.77396	0.16258	2	245.8415	13.0585	6.6642	0.0336387	0.03363871	0.011341	0.0003829	19.081996	14.97496
1239.99568	137.67305	94.93228	0.77866	0.16258	2	245.7797	13.1203	6.7260	0.0344484	0.03444839	0.011617	0.0004017	19.549683	15.45803
1239.9969	138.15611	94.90763	0.78358	0.16258	2	245.7159	13.1841	6.7898	0.0352845	0.03528453	0.011926	0.0004216	20.033073	15.94109
1239.99376	138.63917	94.88447	0.78859	0.16258	2	245.6559	13.2441	6.8498	0.0360701	0.03607013	0.012170	0.0004408	20.487635	16.42415
1239.99102	139.12224	94.86142	0.79306	0.16258	2	245.5962	13.3038	6.9094	0.036852	0.03685199	0.012438	0.0004603	20.940414	16.90722
1239.9973	139.6053	94.83768	0.79716	0.16258	2	245.5348	13.3652	6.9709	0.0376573	0.03765721	0.012713	0.0004808	21.40714	17.39028
1239.9952	140.08836	94.81384	0.80172	0.16258	2	245.4730	13.4270	7.0326	0.0384659	0.03846593	0.01299	0.0005018	21.876234	17.87334
1239.99503	140.57143	94.79034	0.80719	0.16258	2	245.4122	13.4878	7.0935	0.0392631	0.03926306	0.013262	0.000523	22.339032	18.35641
1239.98567	141.05449	94.76629	0.81223	0.16258	2	245.3499	13.5501	7.1557	0.0400789	0.04007885	0.013542	0.0005452	22.813067	18.83947
1239.98722	141.53755	94.74381	0.81834	0.16258	2	245.2917	13.6083	7.2139	0.0408414	0.04084138	0.013803	0.0005663	23.256529	19.32253
1239.9911	142.02062	94.72175	0.82185	0.16258	2	245.2346	13.6654	7.2711	0.0415897	0.04158967	0.01406	0.0005875	23.692056	19.8056
1239.99752	142.50368	94.69857	0.82693	0.16258	2	245.1746	13.7254	7.3311	0.042376	0.04237595	0.014329	0.0006101	24.150068	20.28866
1239.99053	142.98674	94.67514	0.83258	0.16258	2	245.1139	13.7861	7.3917	0.0431707	0.04317070	0.014602	0.0006335	24.61341	20.77172
1239.99173	143.46981	94.65238	0.83615	0.16258	2	245.0550	13.8450	7.4507	0.0439427	0.04394273	0.014867	0.0006566	25.063877	21.25479
1239.99445	143.95287	94.62995	0.84119	0.16258	2	244.9969	13.9031	7.5087	0.0447036	0.04470357	0.015128	0.0006797	25.508176	21.73785
1239.99437	144.43593	94.60683	0.8453	0.16258	2	244.9371	13.9629	7.5686	0.0454878	0.04548781	0.015398	0.000704	25.96652	22.22091
1239.99142	144.919	94.58341	0.85068	0.16258	2	244.8764	14.0236	7.6292	0.0462822	0.04628223	0.015671	0.0007291	26.431202	22.70398
1239.99889	145.40206	94.56061	0.85556	0.16258	2	244.8174	14.0826	7.6882	0.0470556	0.04705562	0.015937	0.000754	26.883961	23.18704
1239.99345	145.88512	94.53869	0.8598	0.16258	2	244.7607	14.1393	7.7450	0.0477992	0.04779916	0.016193	0.0007782	27.319597	23.6701
1239.99192	146.36819	94.51699	0.86448	0.16258	2	244.7045	14.1955	7.8012	0.0485352	0.04853523	0.016474	0.0008027	27.751202	24.15317

APPENDIX 10: Data for the reactivity of Springlake anthracite at 1290°C.

Temp./- C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	mg change	mg evolved	CO evolved	%R	%R(adj)
1289.99697	137.56002	94.03215	0.63681	0.14678	242.6029	15.3971	6.1824	0	0
1289.999	138.05307	93.97403	0.64178	0.14678	242.4530	15.5470	6.3324	0.0006447	0.0030829
1289.99395	138.54611	93.91855	0.64731	0.14678	242.3099	15.6901	6.4755	0.0025172	0.00900591
1289.99968	139.03916	93.8683	0.65162	0.14678	242.1802	15.8198	6.6052	0.0042133	0.0135075
1290.00228	139.53221	93.81302	0.65641	0.14678	242.0376	15.9624	6.7478	0.0060791	0.01802517
1289.99583	140.02525	93.75861	0.6612	0.14678	241.8972	16.1028	6.8882	0.0079155	0.02218719
1290.00248	140.5183	93.7063	0.66566	0.14678	241.7623	16.2377	7.0231	0.0096811	0.02599687
1289.98501	141.01135	93.65021	0.6699	0.14679	241.6175	16.3825	7.1678	0.0115742	0.02992038
1289.99347	141.50439	93.5995	0.67482	0.14678	241.4867	16.5133	7.2987	0.0132857	0.03335067
1289.99885	141.99744	93.54689	0.67907	0.14678	241.3510	16.6490	7.4344	0.0150614	0.03681125
1290.0014	142.49049	93.49487	0.684	0.14678	241.2168	16.7832	7.5686	0.0168172	0.04014837
1289.99353	142.98353	93.4416	0.68922	0.14678	241.0793	16.9207	7.7060	0.0186151	0.04348955
1290.00073	143.47658	93.38706	0.69399	0.14678	240.9386	17.0614	7.8468	0.020456	0.04683984
1289.99603	143.96963	93.33181	0.70012	0.14678	240.7961	17.2039	7.9893	0.0223208	0.05016882
1289.9883	144.46267	93.27793	0.70388	0.14678	240.6571	17.3429	8.1283	0.0241393	0.05335858
1289.99365	144.95572	93.2231	0.70963	0.14678	240.5156	17.4844	8.2698	0.0259899	0.05655244
1289.98917	145.44877	93.16967	0.71539	0.14678	240.3777	17.6223	8.4076	0.0277933	0.05961842
1289.99051	145.94181	93.11448	0.71957	0.14678	240.2354	17.7646	8.5500	0.029656	0.06274121
1289.98833	146.43486	93.0636	0.72447	0.14678	240.1041	17.8959	8.6813	0.0313733	0.06558327
1289.98796	146.92791	93.01054	0.73052	0.14678	239.9672	18.0328	8.8182	0.0331642	0.06851202
1289.99219	147.42095	92.95602	0.73552	0.14678	239.8265	18.1735	8.9588	0.0350043	0.07148647
1289.99651	147.914	92.90291	0.73984	0.14678	239.6895	18.3105	9.0959	0.0367969	0.07435212
1290.00334	148.40705	92.84993	0.74401	0.14678	239.5528	18.4472	9.2326	0.0385851	0.07718126
1290.00725	148.90009	92.79682	0.74974	0.14678	239.4158	18.5842	9.3696	0.0403776	0.07998945
1289.99739	149.39314	92.7414	0.75589	0.14678	239.2728	18.7272	9.5126	0.0422481	0.08289161
1290.00844	149.88619	92.68491	0.76143	0.14678	239.1271	18.8729	9.6583	0.0441548	0.08582176
1290.00281	150.37923	92.63078	0.7656	0.14678	238.9874	19.0126	9.7980	0.0459818	0.08860431
1289.99842	150.87228	92.57421	0.77081	0.14678	238.8415	19.1585	9.9439	0.0478911	0.09148724
1290.00586	151.36533	92.51781	0.77593	0.14678	238.6959	19.3041	10.0894	0.0497947	0.09433722
1289.99432	151.85837	92.46294	0.781	0.14678	238.5544	19.4456	10.2310	0.0516467	0.0970877
1289.99288	152.35142	92.4064	0.78592	0.14678	238.4085	19.5915	10.3769	0.053555	0.0999
1289.99746	152.84447	92.34635	0.79108	0.14678	238.2536	19.7464	10.5318	0.0555818	0.10286362
1289.99956	153.33751	92.29303	0.79625	0.14678	238.1160	19.8840	10.6694	0.0573814	0.10547584
1289.99223	153.83056	92.23793	0.80183	0.14678	237.9739	20.0261	10.8115	0.0592411	0.108157
1289.9982	154.32361	92.17991	0.80638	0.14678	237.8242	20.1758	10.9612	0.0611994	0.11096094
1290.00575	154.81665	92.12169	0.81205	0.14678	237.6740	20.3260	11.1114	0.0631644	0.1137554
1290.00523	155.3097	92.06516	0.81536	0.14678	237.5281	20.4719	11.2573	0.0650724	0.11645107
1289.99403	155.80274	92.00627	0.82249	0.14678	237.3762	20.6238	11.4092	0.0670601	0.11924144
1289.9952	156.29579	91.94817	0.82713	0.14678	237.2263	20.7737	11.5591	0.0690211	0.12197716
1290.00323	156.78884	91.8917	0.83154	0.14678	237.0806	20.9194	11.7048	0.070927	0.12462031
1289.99936	157.28188	91.83487	0.83899	0.14678	236.9340	21.0660	11.8514	0.0728451	0.12726507
1289.99132	157.77493	91.77351	0.84511	0.14678	236.7757	21.2243	12.0097	0.0749161	0.13010406
1289.99041	158.26798	91.71597	0.84888	0.14678	236.6272	21.3728	12.1582	0.0768582	0.13275115
1289.99883	158.76102	91.65983	0.85364	0.14678	236.4824	21.5176	12.3030	0.078753	0.13532013
1290.00243	159.25407	91.5985	0.85806	0.14678	236.3241	21.6759	12.4612	0.080823	0.13811161

1289.99348	159.74712	91.53729	0.86366	0.14678	236.1662	21.8338	12.6192	0.082889	0.14088248
1290.0034	160.24016	91.47843	0.86918	0.14678	236.0143	21.9857	12.7710	0.0848756	0.14353313
1290.00261	160.73321	91.41563	0.87359	0.14678	235.8523	22.1477	12.9330	0.0869952	0.14634669
1289.99756	161.22626	91.35497	0.8788	0.14678	235.6958	22.3042	13.0896	0.0890426	0.14905053
1289.9984	161.7193	91.29321	0.88424	0.14678	235.5365	22.4635	13.2489	0.0911271	0.15178984
1290.00685	162.21235	91.23402	0.88962	0.14678	235.3838	22.6162	13.4016	0.0931249	0.15440265
1289.9979	162.7054	91.17125	0.89472	0.14678	235.2218	22.7782	13.5636	0.0952435	0.15716049

APPENDIX 11: Data for the reactivity of Springlake anthracite at 1340^{o}C.

Temp./- C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	mg change	mg evolved	CO evolved	%R	bouyancy %R(adj)
1340.6308	132.30565	93.95457	-2.63007	0.13099	244.56375	15.73625	9.40214	0	0
1341.00875	132.80872	93.71517	1.14889	0.13087	243.94059	16.35941	10.02530	0.0053801	0.005380143
1340.55801	133.31178	93.56273	0.43253	0.13101	243.54379	16.75621	10.42210	0.0105842	0.010584167
1340.47249	133.81484	93.39548	0.61748	0.13103	243.10843	17.19157	10.85745	0.0162938	0.016293777
1340.36494	134.31791	93.23214	0.58657	0.13107	242.68326	17.61674	11.28263	0.0218699	0.021869907
1340.29439	134.82097	93.0645	0.60749	0.13109	242.24689	18.05311	11.71899	0.0275928	0.027592831
1340.21966	135.32403	92.89925	0.61993	0.13111	241.81675	18.48325	12.14914	0.0332342	0.033234165
1340.17863	135.8271	92.73206	0.63129	0.13113	241.38155	18.91845	12.58433	0.0389417	0.038941727
1340.13917	136.33016	92.56216	0.64554	0.13114	240.93930	19.36070	13.02658	0.0447418	0.044741803
1340.10092	136.83322	92.39539	0.66041	0.13115	240.50520	19.79480	13.46069	0.050435	0.050435027
1340.08078	137.33629	92.22454	0.6729	0.13116	240.06048	20.23952	13.90541	0.0562675	0.056267534
1340.05188	137.83935	92.05154	0.68626	0.13116	239.61016	20.68984	14.35573	0.0621734	0.062173439
1340.03838	138.34241	91.87253	0.69929	0.13117	239.14420	21.15580	14.82169	0.0682845	0.068284514
1340.03387	138.84548	91.69434	0.71613	0.13117	238.68037	21.61963	15.28552	0.0743676	0.074367596
1340.02896	139.34854	91.51365	0.73078	0.13117	238.21003	22.08997	15.75585	0.080536	0.080536024
1340.02267	139.8516	91.33161	0.74389	0.13117	237.73618	22.56382	16.22971	0.0867505	0.086750537
1340.01903	140.35467	91.14453	0.75861	0.13117	237.24921	23.05079	16.71667	0.0931371	0.093137108
1340.00506	140.85773	90.95545	0.77446	0.13118	236.75704	23.54296	17.20885	0.099592	0.099591954
1340.00755	141.36079	90.76384	0.78722	0.13118	236.25828	24.04172	17.70761	0.1061332	0.10613317
1340.00265	141.86386	90.56802	0.80093	0.13118	235.74856	24.55144	18.21733	0.1128181	0.112818108
1340.00262	142.36692	90.37219	0.81534	0.13118	235.23881	25.06119	18.72708	0.1195034	0.119503388
1339.99921	142.86998	90.1742	0.82892	0.13118	234.72344	25.57656	19.24244	0.1262624	0.126262406
1339.99545	143.37305	89.97425	0.84103	0.13118	234.20297	26.09703	19.76291	0.1330883	0.133088334
1339.98947	143.87611	89.76792	0.85357	0.13118	233.66590	26.63410	20.29999	0.1401321	0.140132064
1339.99082	144.37917	89.56212	0.86416	0.13118	233.13020	27.16980	20.83569	0.1471577	0.147157701
1339.99322	144.88224	89.35885	0.87494	0.13118	232.60109	27.69891	21.36480	0.154097	0.154096969
1340.002	145.3853	89.15143	0.88623	0.13118	232.06117	28.23883	21.90471	0.1611779	0.161177909
1340.00494	145.88836	88.94469	0.89771	0.13118	231.52303	28.77697	22.44286	0.1682356	0.168235636
1340.00432	146.39143	88.73156	0.90672	0.13118	230.96825	29.33175	22.99764	0.1755115	0.175511506
1339.993	146.89449	88.52207	0.91475	0.13118	230.42295	29.87705	23.54294	0.1826631	0.182663113
1339.99555	147.39755	88.31188	0.92206	0.13118	229.87582	30.42418	24.09006	0.1898386	0.189838616
1340.00262	147.90062	88.10168	0.92996	0.13118	229.32867	30.97133	24.63721	0.1970145	0.197014461
1339.9954	148.40368	87.89064	0.93629	0.13118	228.77934	31.52066	25.18655	0.204219	0.204218982
1340.00119	148.90674	87.67971	0.94253	0.13118	228.23029	32.06971	25.73560	0.2114197	0.211419748
1339.99261	149.40981	87.47004	0.94894	0.13118	227.68451	32.61549	26.28137	0.2185775	0.2185775
1339.9963	149.91287	87.26263	0.95457	0.13118	227.14463	33.15537	26.82126	0.2256581	0.225658099
1339.99253	150.41593	87.0541	0.9597	0.13118	226.60182	33.69818	27.36406	0.2327769	0.232776933
1339.98901	150.919	86.84376	0.96446	0.13118	226.05431	34.24569	27.91158	0.2399576	0.239957558
1339.99634	151.42206	86.6357	0.96947	0.13118	225.51273	34.78727	28.45316	0.2470603	0.247060347
1340.00391	151.92512	86.43052	0.9746	0.13118	224.97864	35.32136	28.98724	0.2540648	0.254064818
1339.99704	152.42819	86.22628	0.97897	0.13118	224.44701	35.85299	29.51888	0.2610372	0.2610372
1340.00007	152.93125	86.02057	0.9818	0.13118	223.91154	36.38846	30.05434	0.2680598	0.268059764
1340.00672	153.43431	85.8158	0.98572	0.13118	223.37853	36.92147	30.58736	0.2750502	0.275050239
1340.00182	153.93738	85.61251	0.98901	0.13118	222.84936	37.45064	31.11652	0.2819902	0.281990189

1340.00394	154.44044	85.41188	0.99291	0.13118	222.32712	37.97288	31.63876	0.2888393	0.288839331
1339.99637	154.9435	85.2129	0.99551	0.13118	221.80918	38.49082	32.15671	0.2956321	0.295632146
1339.99228	155.44657	85.01466	0.9993	0.13118	221.29316	39.00684	32.67273	0.3023997	0.302399698
1339.99852	155.94963	84.81658	1.00347	0.13118	220.77756	39.52244	33.18833	0.3091618	0.309161789
1339.99902	156.45269	84.61972	1.00737	0.13118	220.26513	40.03487	33.70075	0.3158822	0.31588223
1339.99915	156.95576	84.42787	1.01082	0.13118	219.76575	40.53425	34.20014	0.3224316	0.32243164
1339.99507	157.45882	84.23544	1.01363	0.13118	219.26485	41.03515	34.70104	0.3290008	0.329000849
1340.00286	157.96188	84.04394	1.01604	0.13118	218.76638	41.53362	35.19951	0.3355383	0.33553831

APPENDIX 12: Data for the reactivity of Springlake anthracite at 1390^{o}C.

Temp./- C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(µ V/mW)	mg change	mg evolved	CO evolved	%R	%R(adj)
1389.84799	136.98792	91.67852	0.45134	0.11608	237.6307	21.5693	15.5709	0	0
1390.94362	137.50098	91.24361	0.54673	0.11575	236.5034	22.6966	16.6982	0.0290722	0.01432758
1390.53942	138.01404	90.86278	0.75607	0.11587	235.5163	23.6837	17.6853	0.0419534	0.02224949
1390.40045	138.52711	90.41708	0.79295	0.11591	234.3611	24.8389	18.8405	0.0570287	0.03215973
1390.30054	139.04017	90.02676	0.81783	0.11594	233.3494	25.8506	19.8523	0.0702309	0.04128897
1390.22166	139.55323	89.62384	0.84087	0.11596	232.3050	26.8950	20.8966	0.0838593	0.05108125
1390.17141	140.0663	89.2031	0.86145	0.11598	231.2144	27.9856	21.9872	0.0980904	0.06165268
1390.11738	140.57936	88.77595	0.87674	0.116	230.1073	29.0927	23.0944	0.1125384	0.0727044
1390.10741	141.09242	88.36283	0.89024	0.116	229.0365	30.1635	24.1652	0.1265117	0.08366754
1390.08024	141.60549	87.90553	0.90169	0.11601	227.8511	31.3489	25.3505	0.1419795	0.09608833
1390.05209	142.11855	87.49561	0.90979	0.11602	226.7886	32.4114	26.4130	0.1558446	0.10745588
1390.04499	142.63161	87.0656	0.91642	0.11602	225.6740	33.5260	27.5276	0.1703893	0.11959988
1390.03824	143.14468	86.6764	0.92031	0.11602	224.6652	34.5348	28.5364	0.1835536	0.13077222
1390.02253	143.65774	86.27694	0.92392	0.11602	223.6298	35.5702	29.5718	0.1970649	0.14240697
1390.01112	144.1708	85.86056	0.92588	0.11603	222.5506	36.6494	30.6510	0.2111486	0.15470553
1390.01112	144.68387	85.45663	0.92358	0.11603	221.5036	37.6964	31.6980	0.2248111	0.16679437
1390.00133	145.19693	85.0566	0.92329	0.11603	220.4667	38.7333	32.7349	0.2383418	0.17891229
1390.01316	145.70999	84.64312	0.92036	0.11603	219.3950	39.8050	33.8067	0.2523273	0.19158307
1389.99042	146.22306	84.27874	0.91688	0.11603	218.4505	40.7495	34.7511	0.2646521	0.20286655
1389.99441	146.73612	83.89447	0.91266	0.11603	217.4545	41.7455	35.7472	0.2776497	0.21488031
1390.00479	147.24918	83.52889	0.90962	0.11603	216.5069	42.6931	36.6947	0.2900151	0.22641473
1390.01049	147.76225	83.15937	0.9046	0.11603	215.5491	43.6509	37.6525	0.3025137	0.23817386
1390.00688	148.27531	82.80715	0.90002	0.11603	214.6361	44.5639	38.5655	0.3144272	0.24947335
1390.00198	148.78837	82.4224	0.8951	0.11603	213.6389	45.5611	39.5628	0.327441	0.26191459
1390.00522	149.30144	82.08473	0.89002	0.11603	212.7636	46.4364	40.4380	0.3388624	0.27291539
1389.99943	149.8145	81.7748	0.88515	0.11603	211.9603	47.2397	41.2413	0.3493455	0.283078
1389.99157	150.32756	81.44331	0.88035	0.11603	211.1011	48.0989	42.1006	0.3605578	0.29401525
1389.99752	150.84063	81.11393	0.8755	0.11603	210.2473	48.9527	42.9543	0.3716987	0.30495047
1389.99349	151.35369	80.79764	0.87028	0.11603	209.4275	49.7725	43.7741	0.3823969	0.31551303
1389.99494	151.86675	80.48484	0.86599	0.11603	208.6167	50.5833	44.5849	0.3929771	0.32601734
1389.99188	152.37982	80.18351	0.86207	0.11603	207.8357	51.3643	45.3660	0.4031693	0.33619012
1389.99249	152.89288	79.88464	0.85738	0.11603	207.0610	52.1390	46.1406	0.4132783	0.34633079
1390.0006	153.40594	79.59274	0.85408	0.11603	206.3044	52.8956	46.8972	0.4231515	0.35628299
1389.99609	153.91901	79.29748	0.8512	0.11603	205.5391	53.6609	47.6626	0.4331384	0.3663971
1389.99172	154.43207	79.0223	0.84779	0.11603	204.8258	54.3742	48.3758	0.4424461	0.37586548
1389.99886	154.94513	78.74912	0.84512	0.11603	204.1177	55.0823	49.0839	0.4516861	0.38530454
1390.00517	155.4582	78.47596	0.84259	0.11603	203.4097	55.7903	49.7919	0.4609255	0.3947816
1390.00001	155.97126	78.21763	0.83975	0.11603	202.7401	56.4599	50.4615	0.4696633	0.40377918
1390.00269	156.48432	77.95541	0.83714	0.11603	202.0604	57.1396	51.1412	0.4785326	0.41294656
1390.01351	156.99739	77.69848	0.8344	0.11603	201.3945	57.8055	51.8072	0.487223	0.42196202
1390.00551	157.51045	77.45274	0.83299	0.11603	200.7575	58.4425	52.4441	0.4955349	0.43061498
1389.99985	158.02351	77.20761	0.83094	0.11603	200.1221	59.0779	53.0795	0.5038262	0.43927544
1389.99636	158.53658	76.96571	0.83045	0.11603	199.4951	59.7049	53.7065	0.5120083	0.44784977
1390.00492	159.04964	76.72948	0.82762	0.11603	198.8828	60.3172	54.3188	0.5199985	0.45624962
1389.99609	159.5627	76.50318	0.82689	0.11603	198.2962	60.9038	54.9054	0.5276529	0.46432063

1389.99825	160.07577	76.2756	0.82558	0.11603	197.7064	61.4936	55.4953	0.5353506	0.47246094
1389.99743	160.58883	76.05071	0.82352	0.11603	197.1234	62.0766	56.0782	0.5429572	0.48052806
1390.00151	161.10189	75.836	0.82251	0.11603	196.5669	62.6331	56.6347	0.5502196	0.48825114
1390.01386	161.61496	75.61232	0.82228	0.11603	195.9871	63.2129	57.2145	0.5577854	0.49631858

APPENDIX 13: Data for the reactivity of China nuts coke.

Temp./- C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(μV/mW)	mg change	mg evolved	CO evolved	%R
888.50086	86.86712	99.62897	0.19934	0.25802	249.7698278	0.93017221		
893.63769	87.38113	99.61628	0.20289	0.257	249.738014	0.96198604		
898.78054	87.89514	99.6055	0.20591	0.25596	249.7109885	0.9890115	0	0
903.92066	88.40914	99.59391	0.2089	0.25491	249.6819324	1.01806763	0.02905613	0.0003801
909.05539	88.92315	99.58253	0.21185	0.25384	249.6534027	1.04659729	0.05758579	0.0007533
914.22441	89.43716	99.56998	0.21476	0.25276	249.6219399	1.07806014	0.08904864	0.0011649
919.36328	89.95116	99.55885	0.21918	0.25167	249.594037	1.10596305	0.11695155	0.00153
924.49704	90.46517	99.54777	0.22294	0.25057	249.5662594	1.13374061	0.14472911	0.0018934
929.64312	90.97918	99.53413	0.22583	0.24945	249.5320639	1.16793609	0.17892459	0.0023407
934.78124	91.49318	99.52227	0.22865	0.24832	249.5023309	1.19766911	0.20865761	0.0027297
939.92369	92.00719	99.50877	0.2315	0.24718	249.4684864	1.23151361	0.24250211	0.0031724
945.058	92.5212	99.49578	0.23384	0.24602	249.4359205	1.26407954	0.27506804	0.0035985
950.19373	93.0352	99.48104	0.2366	0.24486	249.3989673	1.30103272	0.31202122	0.0040819
955.33461	93.54921	99.46789	0.23888	0.24367	249.3660002	1.33399977	0.34498827	0.0045132
960.48116	94.06322	99.45252	0.2415	0.24248	249.3274676	1.37253236	0.38352086	0.0050173
965.61235	94.57722	99.43778	0.24518	0.24127	249.2905145	1.40948554	0.42047404	0.0055007
970.7568	95.09123	99.42404	0.2483	0.24005	249.2560683	1.44393172	0.45492022	0.0059513
975.8936	95.60524	99.40885	0.25161	0.23882	249.217987	1.48201305	0.49300155	0.0064495
981.04162	96.11924	99.39288	0.25444	0.23757	249.1779502	1.52204984	0.53303834	0.0069733
986.19511	96.63325	99.37777	0.25633	0.23631	249.1400694	1.55993061	0.57091911	0.0074688
991.332	97.14726	99.36093	0.25945	0.23504	249.0978515	1.60214849	0.61313699	0.0080211
996.4918	97.66126	99.34417	0.26116	0.23376	249.0558342	1.64416581	0.65515431	0.0085708
1001.64711	98.17527	99.328	0.26393	0.23246	249.015296	1.684704	0.6956925	0.0091011
1006.78582	98.68928	99.31151	0.26826	0.23115	248.9739556	1.72604443	0.73703293	0.0096419
1011.93392	99.20328	99.2906	0.27094	0.22983	248.9215342	1.7784658	0.7894543	0.0103277
1017.08778	99.71729	99.27237	0.27409	0.2285	248.8758316	1.82416841	0.83515691	0.0109256
1022.23132	100.2313	99.25246	0.27668	0.22716	248.8259172	1.87408278	0.88507128	0.0115786
1027.37106	100.7453	99.2314	0.27795	0.22581	248.7731198	1.9268802	0.9378687	0.0122693
1032.51656	101.25931	99.20631	0.27994	0.22444	248.7102192	1.98978083	1.00076933	0.0130921
1037.65286	101.77332	99.18306	0.28115	0.22307	248.6519314	2.04806858	1.05905708	0.0138547
1042.80388	102.28732	99.15844	0.28294	0.22168	248.5902091	2.10979092	1.12077942	0.0146621
1047.93609	102.80133	99.13026	0.2835	0.22028	248.5195618	2.18043818	1.19142668	0.0155863
1053.07995	103.31534	99.10038	0.28422	0.21888	248.4446527	2.25534734	1.26633584	0.0165663
1058.22794	103.82934	99.06979	0.28524	0.21746	248.3679635	2.33203647	1.34302497	0.0175696
1063.35938	104.34335	99.03704	0.286	0.21603	248.2858593	2.41414072	1.42512922	0.0186437
1068.50551	104.85736	99.00155	0.28658	0.2146	248.1968859	2.50311415	1.51410265	0.0198076
1073.64467	105.37136	98.96289	0.28698	0.21315	248.0999652	2.60003477	1.61102327	0.0210755
1078.78234	105.88537	98.92383	0.28683	0.21169	248.0020418	2.69795819	1.70894669	0.0223566
1083.92779	106.39938	98.88319	0.28769	0.21022	247.9001573	2.79984267	1.81083117	0.0236894
1089.06467	106.91338	98.84001	0.28886	0.20875	247.7919051	2.90809493	1.91908343	0.0251056
1094.2117	107.42739	98.79499	0.28952	0.20726	247.6790399	3.02096007	2.03194857	0.0265821
1099.34906	107.9414	98.74805	0.29174	0.20577	247.5613614	3.13863865	2.14962715	0.0281216
1104.4934	108.4554	98.70032	0.29252	0.20427	247.4417022	3.25829776	2.26928626	0.029687
1109.63477	108.96941	98.6534	0.29507	0.20276	247.3240738	3.3759262	2.3869147	0.0312258
1114.76717	109.48342	98.60669	0.29695	0.20125	247.2069718	3.49302817	2.50401667	0.0327578

1119.91521	109.99742	98.56019	0.29919	0.19972	247.0903963	3.60960367	2.62059217	0.0342828
1125.05993	110.51143	98.51691	0.29974	0.19819	246.9818934	3.71810663	2.72909513	0.0357022
1130.19843	111.02544	98.47454	0.30132	0.19665	246.8756718	3.82432822	2.83531672	0.0370918
1135.33733	111.53944	98.43562	0.3017	0.1951	246.7780993	3.92190066	2.93288916	0.0383683
1140.48218	112.05345	98.3993	0.30485	0.19355	246.6870451	4.0129549	3.0239434	0.0395595
1145.62011	112.56746	98.36597	0.30628	0.19199	246.6034868	4.09651321	3.10750171	0.0406526
1150.7695	113.08146	98.33332	0.30648	0.19042	246.5216332	4.17836676	3.18935526	0.0417234

APPENDIX 14: Data for the reactivity of China nuts coke at 1190^{o}C.

Temp./~ C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	CO evolved	%R
1190.96383	117.31557	98.09555	0.54446	0.17801	2	246.71031	4.78969	3.80990	0
1191.72335	117.78862	98.06881	0.69757	0.17777	2	246.64306	4.85694	3.87715	0.010347927
1191.12515	118.26167	98.0511	0.81785	0.17796	2	246.59852	4.90148	3.92169	0.010928575
1190.9944	118.73471	98.03394	0.82976	0.178	2	246.55536	4.94464	3.96485	0.011491191
1190.86069	119.20776	98.01662	0.83429	0.17804	2	246.51180	4.98820	4.00841	0.012059052
1190.74869	119.68081	97.99974	0.84097	0.17808	2	246.46935	5.03065	4.05086	0.012612488
1190.63309	120.15385	97.98393	0.84752	0.17811	2	246.42958	5.07042	4.09062	0.013130842
1190.54331	120.6269	97.96774	0.85376	0.17814	2	246.38887	5.11113	4.13134	0.013661654
1190.4592	121.09995	97.95191	0.85931	0.17817	2	246.34905	5.15095	4.17115	0.014180664
1190.3973	121.57299	97.93785	0.86451	0.17818	2	246.31369	5.18631	4.20651	0.014641642
1190.34732	122.04604	97.9227	0.87042	0.1782	2	246.27559	5.22441	4.24462	0.015138356
1190.2829	122.51909	97.90811	0.87628	0.17822	2	246.23890	5.26110	4.28131	0.015616711
1190.23705	122.99213	97.89468	0.88221	0.17823	2	246.20512	5.29488	4.31509	0.016057033
1190.2119	123.46518	97.88056	0.88791	0.17824	2	246.16961	5.33039	4.35060	0.016519978
1190.1872	123.93823	97.86829	0.89304	0.17825	2	246.13875	5.36125	4.38146	0.016922267
1190.15131	124.41127	97.85572	0.89941	0.17826	2	246.10714	5.39286	4.41307	0.017334393
1190.12224	124.88432	97.84336	0.90607	0.17827	2	246.07605	5.42395	4.44416	0.017739634
1190.10717	125.35737	97.83181	0.91091	0.17828	2	246.04700	5.45300	4.47320	0.018118317
1190.08895	125.83041	97.818	0.91656	0.17828	2	246.01227	5.48773	4.50794	0.018571098
1190.07449	126.30346	97.8054	0.9225	0.17829	2	245.98058	5.51942	4.53963	0.018984208
1190.06024	126.77651	97.79351	0.92808	0.17829	2	245.95068	5.54932	4.56953	0.019374038
1190.04497	127.24955	97.78094	0.93334	0.17829	2	245.91906	5.58094	4.60114	0.019786164
1190.04242	127.7226	97.76992	0.9387	0.1783	2	245.89135	5.60865	4.62886	0.020147471
1190.02422	128.19565	97.75935	0.94447	0.1783	2	245.86477	5.63523	4.65544	0.020494024
1190.01387	128.66869	97.74762	0.9502	0.1783	2	245.83526	5.66474	4.68494	0.020878609
1190.01195	129.14174	97.73676	0.95568	0.17831	2	245.80795	5.69205	4.71225	0.02123467
1190.0034	129.61479	97.72582	0.96155	0.17831	2	245.78044	5.71956	4.73977	0.021593354
1190.00304	130.08783	97.71462	0.96782	0.17831	2	245.75227	5.74773	4.76794	0.021960562
1190.00166	130.56088	97.70299	0.97346	0.17831	2	245.72302	5.77698	4.79719	0.022341868
1190.01729	131.03393	97.69198	0.9785	0.1783	2	245.69533	5.80467	4.82488	0.022702847
1189.99726	131.50697	97.68006	0.98468	0.17831	2	245.66535	5.83465	4.85486	0.023093662
1190.00432	131.98002	97.66857	0.99075	0.17831	2	245.63645	5.86355	4.88375	0.023470378
1190.00338	132.45307	97.6586	0.99709	0.17831	2	245.61138	5.88862	4.90883	0.023797259
1189.99768	132.92611	97.64805	1.00272	0.17831	2	245.58485	5.91515	4.93536	0.024143156
1189.99631	133.39916	97.63656	1.0083	0.17831	2	245.55595	5.94405	4.96426	0.024519873
1190.0048	133.87221	97.6271	1.01518	0.17831	2	245.53216	5.96784	4.98805	0.024830033
1189.99363	134.34525	97.61623	1.0215	0.17831	2	245.50482	5.99518	5.01539	0.025186421
1189.99273	134.8183	97.60662	1.0269	0.17831	2	245.48065	6.01935	5.03956	0.025501499
1190.00018	135.29135	97.59406	1.0322	0.17831	2	245.44906	6.05094	5.07115	0.025913297
1189.99675	135.76439	97.58401	1.03776	0.17831	2	245.42379	6.07621	5.09642	0.026242801
1189.99328	136.23744	97.57293	1.04323	0.17831	2	245.39592	6.10408	5.12429	0.026606075
1189.98422	136.71049	97.56205	1.04898	0.17831	2	245.36856	6.13144	5.15165	0.026962791
1189.99729	137.18353	97.55267	1.05492	0.17831	2	245.34497	6.15503	5.17524	0.027270328
1189.99485	137.65658	97.54246	1.06038	0.17831	2	245.31929	6.18071	5.20092	0.027605078

1189.9919	138.12963	97.53226	1.06709	0.17831	2	245.29363	6.20637	5.22657	0.0279395
1189.99096	138.60267	97.52049	1.07271	0.17831	2	245.26403	6.23597	5.25617	0.028325397
1189.99802	139.07572	97.51029	1.07815	0.17831	2	245.23838	6.26162	5.28183	0.028659818
1189.99319	139.54877	97.5009	1.08441	0.17831	2	245.21476	6.28524	5.30544	0.028967683
1189.99297	140.02181	97.49073	1.09059	0.17831	2	245.18919	6.31081	5.33102	0.029301121
1189.99397	140.49486	97.48052	1.09664	0.17831	2	245.16351	6.33649	5.35670	0.029635871
1189.9925	140.96791	97.4704	1.1029	0.17831	2	245.13806	6.36194	5.38215	0.02996767
1189.98545	141.44095	97.45933	1.10783	0.17831	2	245.11021	6.38979	5.40999	0.030330616
1189.99962	141.914	97.45066	1.11316	0.17831	2	245.08841	6.41159	5.43180	0.030614875
1189.9895	142.38705	97.43995	1.11973	0.17831	2	245.06147	6.43853	5.45873	0.030966018
1190.00186	142.86009	97.42881	1.12525	0.17831	2	245.03346	6.46654	5.48675	0.031331259
1190.0062	143.33314	97.41922	1.13101	0.17831	2	245.00934	6.49066	5.51087	0.031645681
1189.9978	143.80619	97.41004	1.13668	0.17831	2	244.98625	6.51375	5.53396	0.031946661
1190.0074	144.27923	97.39899	1.14194	0.17831	2	244.95846	6.54154	5.56175	0.032308951
1189.99724	144.75228	97.3903	1.14834	0.17831	2	244.93660	6.56340	5.58360	0.032593865
1189.99146	145.22533	97.37891	1.15331	0.17831	2	244.90796	6.59204	5.61225	0.032967303

APPENDIX 15: Data for the reactivity of China nuts coke at 1240^{o}C.

Temp./~ C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	CO evolved	%R
1239.6783	121.96926	97.72279	0.3132	0.16268	1	244.60014	5.69986	4.57386	0
1241.47755	122.45327	97.6858	0.36019	0.16211	2	244.50756	5.79244	4.66644	0.0022728
1241.22025	122.93727	97.64844	0.55725	0.16219	2	244.41405	5.88595	4.75996	0.0034961
1240.89449	123.42128	97.61628	0.59887	0.1623	2	244.33355	5.96645	4.84045	0.0045492
1240.76319	123.90528	97.58407	0.6106	0.16234	2	244.25293	6.04707	4.92107	0.0056039
1240.64464	124.38929	97.55101	0.62084	0.16238	2	244.17018	6.12982	5.00382	0.0066864
1240.55186	124.87329	97.52112	0.62744	0.16241	2	244.09536	6.20464	5.07864	0.0076651
1240.45588	125.3573	97.49213	0.63294	0.16244	2	244.02280	6.27720	5.15120	0.0086144
1240.38116	125.8413	97.46232	0.63774	0.16246	2	243.94819	6.35181	5.22581	0.0095905
1240.31466	126.32531	97.43492	0.64457	0.16248	2	243.87960	6.42040	5.29440	0.0104877
1240.2743	126.80931	97.4059	0.65036	0.16249	2	243.80697	6.49303	5.36703	0.011438
1240.21712	127.29332	97.37776	0.65595	0.16251	2	243.73653	6.56347	5.43747	0.0123594
1240.19193	127.77732	97.3528	0.66213	0.16252	2	243.67406	6.62594	5.49994	0.0131767
1240.14658	128.26133	97.32613	0.66808	0.16253	2	243.60730	6.69270	5.56670	0.01405
1240.12595	128.74533	97.29881	0.67279	0.16254	2	243.53892	6.76108	5.63508	0.0149446
1240.09855	129.22934	97.27296	0.67837	0.16255	2	243.47422	6.82578	5.69978	0.015791
1240.08022	129.71334	97.24478	0.68381	0.16256	2	243.40368	6.89632	5.77032	0.0167138
1240.0655	130.19735	97.21908	0.68941	0.16256	2	243.33936	6.96064	5.83464	0.0175553
1240.04522	130.68135	97.19241	0.69524	0.16257	2	243.27260	7.02740	5.90140	0.0184286
1240.04232	131.16536	97.16588	0.70055	0.16257	2	243.20620	7.09380	5.96780	0.0192973
1240.03021	131.64936	97.14018	0.70662	0.16257	2	243.14187	7.15813	6.03213	0.0201388
1240.02636	132.13337	97.11525	0.71411	0.16257	2	243.07947	7.22053	6.09453	0.0209551
1240.01975	132.61737	97.09022	0.71929	0.16257	2	243.01682	7.28318	6.15718	0.0217747
1240.01824	133.10138	97.06429	0.72483	0.16257	2	242.95192	7.34808	6.22208	0.0226238
1240.0123	133.58538	97.03777	0.72995	0.16258	2	242.88554	7.41446	6.28846	0.0234922
1240.01759	134.06939	97.01196	0.73548	0.16257	2	242.82094	7.47906	6.35306	0.0243373
1240.00337	134.55339	96.98653	0.74135	0.16258	2	242.75728	7.54272	6.41672	0.02517
1239.99436	135.0374	96.96294	0.74701	0.16258	2	242.69824	7.60176	6.47576	0.0259424
1240.00765	135.5214	96.93611	0.75243	0.16258	2	242.63108	7.66892	6.54292	0.026821
1240.01261	136.00541	96.90944	0.75789	0.16258	2	242.56433	7.73567	6.60967	0.0276943
1239.99341	136.48941	96.88215	0.76281	0.16258	2	242.49602	7.80398	6.67798	0.0285879
1239.98717	136.97342	96.85668	0.7666	0.16258	2	242.43227	7.86773	6.74173	0.0294219
1239.99793	137.45742	96.83159	0.77144	0.16258	2	242.36947	7.93053	6.80453	0.0302434
1239.99028	137.94143	96.80578	0.77709	0.16258	2	242.30487	7.99513	6.86913	0.0310886
1239.99123	138.42543	96.77983	0.78289	0.16258	2	242.23991	8.06009	6.93409	0.0319383
1240.01048	138.90944	96.75333	0.78781	0.16258	2	242.17358	8.12642	7.00042	0.032806
1239.99609	139.39344	96.72758	0.79308	0.16258	2	242.10913	8.19087	7.06487	0.0336492
1239.99898	139.87745	96.70204	0.79826	0.16258	2	242.04521	8.25479	7.12879	0.0344855
1239.99978	140.36145	96.67671	0.80237	0.16258	2	241.98181	8.31819	7.19220	0.0353149
1239.98483	140.84546	96.65034	0.80815	0.16259	2	241.91580	8.38420	7.25820	0.0361784
1240.00056	141.32946	96.6254	0.81316	0.16258	2	241.85338	8.44662	7.32062	0.036995
1239.99531	141.81347	96.59943	0.8183	0.16258	2	241.78837	8.51163	7.38563	0.0378454
1239.99056	142.29747	96.57389	0.8227	0.16258	2	241.72445	8.57555	7.44955	0.0386817
1240.00639	142.78148	96.54894	0.82866	0.16258	2	241.66200	8.63800	7.51200	0.0394987

1240.01281	143.26548	96.52415	0.83324	0.16258	2	241.59995	8.70005	7.57405	0.0403104
1239.99466	143.74949	96.50006	0.83788	0.16258	2	241.53965	8.76035	7.63435	0.0410992
1239.99659	144.23349	96.47588	0.84322	0.16258	2	241.47913	8.82087	7.69487	0.041891
1239.99859	144.7175	96.44981	0.84794	0.16258	2	241.41387	8.88613	7.76013	0.0427446
1239.99274	145.2015	96.42355	0.85315	0.16258	2	241.34815	8.95185	7.82585	0.0436045
1239.99047	145.68551	96.39996	0.858	0.16258	2	241.28910	9.01090	7.88490	0.0443769
1239.99111	146.16951	96.37367	0.86319	0.16258	2	241.22330	9.07670	7.95070	0.0452378
1239.98721	146.65352	96.34852	0.86888	0.16258	2	241.16035	9.13965	8.01365	0.0460613
1239.99458	147.13752	96.32444	0.87358	0.16258	2	241.10007	9.19993	8.07393	0.0468498
1239.99985	147.62153	96.29844	0.87867	0.16258	2	241.03500	9.26500	8.13901	0.0477011
1239.99194	148.10553	96.27317	0.88333	0.16258	2	240.97174	9.32826	8.20226	0.0485286
1239.99067	148.58954	96.24882	0.88809	0.16258	2	240.91080	9.38920	8.26320	0.0493259
1239.99212	149.07354	96.22265	0.8928	0.16258	2	240.84529	9.45471	8.32871	0.0501828
1239.99434	149.55755	96.19907	0.8978	0.16258	2	240.78627	9.51373	8.38773	0.050955
1239.99132	150.04155	96.1761	0.90348	0.16258	2	240.72878	9.57122	8.44522	0.0517071
1239.99661	150.52556	96.15321	0.90869	0.16258	2	240.67148	9.62852	8.50252	0.0524566
1239.99422	151.00956	96.13016	0.91308	0.16258	2	240.61379	9.68621	8.56021	0.0532114
1239.98512	151.49357	96.10733	0.91865	0.16259	2	240.55665	9.74335	8.61735	0.0539589
1239.99785	151.97757	96.08401	0.92344	0.16258	2	240.49828	9.80172	8.67572	0.0547225
1239.99828	152.46158	96.05989	0.92818	0.16258	2	240.43790	9.86210	8.73610	0.0555123

APPENDIX 16: Data for the reactivity of China nuts coke at 1290^{o}C.

Temp./- C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(μV/mW)	mg change	mg evolved	CO evolved	%R	%R(adj)
1290.65495	128.68648	96.93445	0.65008	0.14657	243.20854	7.69146	6.66293	0	0
1290.54667	129.17954	96.85167	0.65608	0.14661	243.00084	7.89916	6.87062	0.002528	0.008982387
1290.43885	129.67259	96.77002	0.66252	0.14664	242.79598	8.10402	7.07548	0.005208	0.015875886
1290.36234	130.16564	96.6922	0.66896	0.14667	242.60073	8.29927	7.27073	0.0077623	0.02174265
1290.29631	130.65869	96.61245	0.6747	0.14669	242.40064	8.49936	7.47082	0.0103799	0.027337652
1290.23283	131.15174	96.53205	0.67933	0.14671	242.19891	8.70109	7.67255	0.0130189	0.032680178
1290.20203	131.64479	96.45232	0.68443	0.14672	241.99887	8.90113	7.87259	0.0156359	0.03775445
1290.15302	132.13785	96.37343	0.68978	0.14673	241.80094	9.09906	8.07052	0.0182253	0.042600148
1290.12861	132.6309	96.29549	0.69501	0.14674	241.60538	9.29462	8.26608	0.0207835	0.047245688
1290.10049	133.12395	96.21765	0.69934	0.14675	241.41008	9.48992	8.46138	0.0233384	0.051765503
1290.08038	133.617	96.14054	0.70414	0.14676	241.21661	9.68339	8.65485	0.0258694	0.05614043
1290.07894	134.11005	96.0635	0.70885	0.14676	241.02332	9.87668	8.84814	0.0283981	0.06042154
1290.05133	134.6031	95.98736	0.71334	0.14676	240.83229	10.06771	9.03917	0.0308972	0.064573831
1290.04042	135.09616	95.91025	0.71723	0.14677	240.63882	10.26118	9.23264	0.0334282	0.068707012
1290.03317	135.58921	95.83632	0.72308	0.14677	240.45333	10.44667	9.41813	0.0358548	0.072607804
1290.02669	136.08226	95.76111	0.72795	0.14677	240.26462	10.63538	9.60684	0.0383234	0.076519092
1290.03156	136.57531	95.68731	0.7327	0.14677	240.07946	10.82054	9.79200	0.0407458	0.080305421
1290.0114	137.06836	95.61284	0.73715	0.14678	239.89262	11.00738	9.97884	0.0431901	0.084078036
1290.01296	137.56141	95.53911	0.74203	0.14678	239.70763	11.19237	10.16383	0.0456101	0.087768801
1290.00082	138.05447	95.46621	0.74763	0.14678	239.52472	11.37528	10.34674	0.0480029	0.091377399
1290.0035	138.54752	95.39094	0.75312	0.14678	239.33587	11.56413	10.53559	0.0504735	0.095063518
1290.01216	139.04057	95.31894	0.75855	0.14678	239.15522	11.74478	10.71624	0.0528367	0.098553844
1290.0072	139.53362	95.24609	0.764	0.14678	238.97244	11.92756	10.89902	0.0552279	0.102051845
1289.99936	140.02667	95.17387	0.76932	0.14678	238.79124	12.10876	11.08022	0.0575984	0.105488032
1289.99653	140.51972	95.09927	0.77406	0.14678	238.60407	12.29593	11.26739	0.060047	0.109006124
1289.99524	141.01278	95.0257	0.77979	0.14678	238.41948	12.48052	11.45198	0.0624617	0.112445968
1289.99677	141.50583	94.95194	0.78542	0.14678	238.23442	12.66558	11.63704	0.0648828	0.115866502
1289.99683	141.99888	94.87843	0.79113	0.14678	238.04998	12.85002	11.82148	0.0672956	0.11924862
1290.00147	142.49193	94.80555	0.79629	0.14678	237.86712	13.03288	12.00434	0.0696877	0.122576462
1289.99693	142.98498	94.733	0.80223	0.14678	237.68510	13.21490	12.18636	0.072069	0.125865263
1290.00002	143.47803	94.66037	0.80745	0.14678	237.50287	13.39713	12.36859	0.0744529	0.12913469
1290.00562	143.97109	94.58554	0.81447	0.14678	237.31512	13.58488	12.55634	0.0769091	0.132480022
1289.98911	144.46414	94.5133	0.82075	0.14678	237.13387	13.76613	12.73759	0.0792802	0.135688138
1289.99232	144.95719	94.44012	0.82542	0.14678	236.95026	13.94974	12.92120	0.0816822	0.138917324
1289.99898	145.45024	94.36505	0.83165	0.14678	236.76191	14.13809	13.10955	0.0841462	0.14220906
1289.99246	145.94329	94.29101	0.83714	0.14678	236.57614	14.32386	13.29532	0.0865764	0.14543567
1289.99752	146.43634	94.21565	0.84208	0.14678	236.38707	14.51293	13.48439	0.08905	0.148700148
1289.99803	146.9294	94.14155	0.84845	0.14678	236.20115	14.69885	13.67031	0.0914821	0.151891349
1289.9906	147.42245	94.06292	0.85502	0.14678	236.00387	14.89613	13.86759	0.094063	0.155258035
1289.9929	147.9155	93.9856	0.8604	0.14678	235.80987	15.09013	14.06159	0.0966009	0.158549585
1289.9944	148.40855	93.91021	0.86667	0.14678	235.62072	15.27928	14.25074	0.0990754	0.161741363
1290.00611	148.9016	93.83044	0.87355	0.14678	235.42057	15.47943	14.45089	0.1016937	0.165100233
1290.00189	149.39465	93.75301	0.87991	0.14678	235.22630	15.67370	14.64516	0.1042352	0.168343078
1289.99574	149.88771	93.6752	0.88479	0.14678	235.03108	15.86892	14.84038	0.1067891	0.171584994
1289.99806	150.38076	93.59841	0.89114	0.14678	234.83841	16.06159	15.03305	0.1093096	0.174768334

1289.99748	150.87381	93.52009	0.89804	0.14678	234.64191	16.25809	15.22955	0.1118803	0.177999112
1289.99513	151.36686	93.44032	0.90458	0.14678	234.44176	16.45824	15.42970	0.1144986	0.181273566
1289.99762	151.85991	93.36172	0.91138	0.14678	234.24456	16.65544	15.62691	0.1170785	0.184484502
1290.00537	152.35296	93.28188	0.91755	0.14678	234.04424	16.85576	15.82722	0.119699	0.187730772
1290.00956	152.84602	93.20079	0.9253	0.14678	233.84078	17.05922	16.03068	0.1223607	0.191012482
1289.99245	153.33907	93.12001	0.93168	0.14678	233.63811	17.26189	16.23336	0.1250121	0.194266631
1289.99515	153.83212	93.03577	0.93865	0.14678	233.42675	17.47325	16.44471	0.1277771	0.197644618
1289.99696	154.32517	92.95453	0.94604	0.14678	233.22292	17.67708	16.64854	0.1304436	0.200887655
1289.99808	154.81822	92.87047	0.95224	0.14678	233.01201	17.88799	16.85945	0.1332027	0.204228504
1289.99597	155.31127	92.78528	0.95848	0.14678	232.79827	18.10173	17.07319	0.1359989	0.20759933
1289.99998	155.80433	92.70093	0.96599	0.14678	232.58663	18.31337	17.28483	0.1387675	0.210922471
1290.00402	156.29738	92.6166	0.97344	0.14678	232.37505	18.52495	17.49641	0.1415355	0.214230802
1290.00084	156.79043	92.53227	0.98071	0.14678	232.16347	18.73653	17.70800	0.1443035	0.217525444

APPENDIX 17: Data for the reactivity of China nuts coke at 1340^{o}C.

Temp./°C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(μV/mW)	Segment	mg change	mg evolved	CO evolved	%R	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1340.21202	132.04974	95.84659	0.38192	0.13111	2	240.47909	10.42091	9.51887	0	0	0	0	0	0
1341.14728	132.55375	95.63549	0.41699	0.13083	2	239.94944	10.95056	10.04852	0.002862	0.000419231	0.0001398	5.8596E-08	0.0328058	0.50401
1340.67102	133.05776	95.44223	0.62133	0.13097	2	239.46456	11.43544	10.53341	0.009199	0.001976274	0.0006592	1.303E-06	0.1547879	1.00802
1340.53028	133.56176	95.24855	0.63048	0.13102	2	238.97861	11.92139	11.01935	0.015549	0.003968348	0.0013245	5.2585E-06	0.3111731	1.51202
1340.42883	134.06577	95.05977	0.6352	0.13105	2	238.50496	12.39504	11.49300	0.021739	0.006192668	0.0020685	1.2818E-05	0.4862187	2.01603
1340.33382	134.56978	94.8722	0.64407	0.13108	2	238.03435	12.86565	11.96361	0.027890	0.008621095	0.002882	2.487E-05	0.6778445	2.52004
1340.26444	135.07378	94.68336	0.65424	0.1311	2	237.56055	13.33945	12.43741	0.034082	0.011251235	0.0037646	4.2409E-05	0.8859991	3.02404
1340.20824	135.57779	94.49466	0.66372	0.13112	2	237.08710	13.81290	12.91086	0.040269	0.014041521	0.0047026	6.6135E-05	1.1075263	3.52805
1340.15709	136.0818	94.30554	0.67519	0.13113	2	236.61260	14.28740	13.38536	0.046471	0.016983207	0.0056934	9.6876E-05	1.3418554	4.03206
1340.12934	136.5858	94.11591	0.68759	0.13114	2	236.13682	14.76318	13.86115	0.052689	0.020065301	0.0067337	0.00013542	1.588234	4.53606
1340.09347	137.08981	93.9261	0.70047	0.13115	2	235.66058	15.23942	14.33738	0.058913	0.023272375	0.0078184	0.00018243	1.8455473	5.04007
1340.08108	137.59382	93.73368	0.71298	0.13116	2	235.17780	15.72220	14.82016	0.065225	0.026639116	0.0089597	0.00023939	2.1167124	5.54408
1340.06577	138.09782	93.53846	0.72744	0.13116	2	234.68800	16.21200	15.30997	0.071623	0.030165882	0.0101581	0.00030747	2.401916	6.04808
1340.04205	138.60183	93.33751	0.74218	0.13117	2	234.18381	16.71619	15.81415	0.078213	0.033905806	0.0114321	0.00038909	2.7056496	6.55209
1340.04362	139.10584	93.13788	0.75817	0.13117	2	233.68294	17.21706	16.31502	0.084758	0.037725036	0.0127365	0.00048253	3.0172049	7.0561
1340.02462	139.60984	92.93599	0.77353	0.13117	2	233.17640	17.72360	16.82157	0.091378	0.04168722	0.0140934	0.00059028	3.3419054	7.56013
1340.01183	140.11385	92.73212	0.78864	0.13118	2	232.66489	18.23511	17.33308	0.098063	0.045785003	0.0155007	0.00071337	3.6793177	8.06411
1340.01691	140.61786	92.52245	0.80354	0.13117	2	232.13883	18.76117	17.85914	0.104938	0.050096036	0.0169856	0.00085573	4.0365061	8.56812
1340.01294	141.12186	92.30991	0.82031	0.13118	2	231.60556	19.29444	18.39240	0.111908	0.054561692	0.0185284	0.00101718	4.4075134	9.07212
1340.01492	141.62587	92.09393	0.83503	0.13118	2	231.06367	19.83633	18.93429	0.118990	0.059194062	0.020134	0.00119981	4.7949216	9.57613
1340.00864	142.12988	91.87715	0.85	0.13118	2	230.51977	20.38023	19.47819	0.126098	0.06393546	0.0217829	0.00140281	5.1936618	10.08014
1340.00938	142.63388	91.65798	0.86564	0.13118	2	229.96987	20.93013	20.02809	0.133284	0.068819111	0.023487	0.00162901	5.6067244	10.58414
1340.00428	143.13789	91.43347	0.87812	0.13118	2	229.40658	21.49342	20.59139	0.140646	0.07391211	0.0252706	0.00188353	6.0400649	11.08815
1339.99653	143.6419	91.20983	0.89116	0.13118	2	228.84546	22.05454	21.15250	0.147979	0.07907309	0.0270847	0.002161	6.4818897	11.59216
1340.00388	144.1459	90.98287	0.90375	0.13118	2	228.27602	22.62398	21.72194	0.155421	0.084397168	0.0289632	0.002468	6.9405497	12.09616
1339.99742	144.64991	90.75447	0.91629	0.13118	2	227.70297	23.19703	22.29500	0.162911	0.08984013	0.0308911	0.00280383	7.412494	12.60017
1340.00505	145.15392	90.52473	0.92643	0.13118	2	227.12655	23.77345	22.87142	0.170443	0.095398467	0.032868	0.00316989	7.8976466	13.10418
1339.99457	145.65792	90.29307	0.93812	0.13118	2	226.54531	24.35469	23.45265	0.178040	0.101085458	0.0348989	0.00356879	8.3974095	13.60818
1339.99494	146.16193	90.06383	0.94971	0.13118	2	225.97015	24.92985	24.02781	0.185572	0.106791962	0.0369455	0.00399405	8.9023593	14.11219
1340.0042	146.66594	89.833	0.95927	0.13118	2	225.39100	25.50900	24.60697	0.193126	0.112615184	0.0390429	0.00445402	9.4212572	14.6162
1340.00869	147.16994	89.60198	0.96685	0.13118	2	224.81137	26.08863	25.18660	0.200701	0.118518647	0.0411786	0.00494738	9.9510755	15.1202

1339.99861	147.67395	89.37146	0.97428	0.13118	2	224.23299	26.66701	25.76497	0.2082601	0.12448265	0.0433459	0.00547373	10.490221	15.62421
1340.00228	148.17796	89.1401	0.98212	0.13118	2	223.65251	27.24749	26.34545	0.2158464	0.13054021	0.0455574	0.00603731	11.041873	16.12822
1339.9928	148.68196	88.90669	0.98806	0.13118	2	223.06689	27.83311	26.93108	0.2234999	0.13672262	0.047825	0.00664291	11.609146	16.63222
1339.99706	149.18597	88.68106	0.99484	0.13118	2	222.50078	28.39922	27.49718	0.2308984	0.14276537	0.0500519	0.00726478	12.1678	17.13623
1339.99909	149.68998	88.45343	1.00182	0.13118	2	221.92966	28.97034	28.06831	0.2383624	0.14892639	0.0523331	0.00792961	12.741705	17.64024
1340.01055	150.19398	88.22558	1.00576	0.13118	2	221.35798	29.54202	28.63998	0.2458336	0.15515706	0.0546514	0.00863386	13.32658	18.14424
1339.99108	150.69799	87.99709	1.0109	0.13118	2	220.78470	30.11530	29.21327	0.2533258	0.16146792	0.0570111	0.00938021	13.92363	18.64825
1340.00805	151.202	87.77182	1.01564	0.13118	2	220.21950	30.68050	29.77847	0.2607124	0.16775009	0.059372	0.01015652	14.522663	19.15226
1339.99065	151.706	87.54919	1.02077	0.13118	2	219.66092	31.23908	30.33705	0.2680125	0.17401627	0.0617386	0.01096433	15.124894	19.65626
1340.00053	152.21001	87.32645	1.02468	0.13118	2	219.10206	31.79794	30.89590	0.2753161	0.18034183	0.0641399	0.01181405	15.737672	20.16027
1339.99668	152.71402	87.10313	1.02789	0.13118	2	218.54175	32.35825	31.45621	0.2826388	0.18673935	0.0665811	0.01270882	16.362428	20.66428
1340.00433	153.21802	86.8827	1.03246	0.13118	2	217.98869	32.91131	32.00927	0.2898667	0.19310764	0.0690239	0.01363519	16.989387	21.16828
1340.00633	153.72203	86.66452	1.03619	0.13118	2	217.44128	33.45872	32.55668	0.2970209	0.19946244	0.0714744	0.01459548	17.620109	21.67229
1340.00107	154.22604	86.44708	1.03895	0.13118	2	216.89572	34.00428	33.10224	0.3041508	0.20584583	0.0739489	0.01559656	18.258854	22.1763
1340.01083	154.73004	86.2307	1.04088	0.13118	2	216.35283	34.54717	33.64514	0.3112459	0.21224702	0.0764438	0.01663752	18.904661	22.6803
1340.00205	155.23405	86.01666	1.04358	0.13118	2	215.81580	35.08420	34.18216	0.3182643	0.21862626	0.0789435	0.01771227	19.55358	23.18431
1340.00111	155.73806	85.8042	1.04571	0.13118	2	215.28274	35.61726	34.71523	0.3252309	0.22500420	0.0814564	0.01882448	20.207752	23.68832
1339.99845	156.24206	85.59466	1.04755	0.13118	2	214.75700	36.14300	35.24096	0.3321017	0.23133855	0.0839658	0.01996679	20.862845	24.19232
1340.00747	156.74607	85.38627	1.05	0.13118	2	214.23415	36.66585	35.76381	0.3389348	0.23768091	0.0864922	0.02114862	21.524222	24.69633
1340.00733	157.25008	85.17872	1.05205	0.13118	2	213.71341	37.18659	36.28456	0.3457404	0.24403953	0.0890392	0.02237213	22.192843	25.20034
1340.00022	157.75408	84.97319	1.05403	0.13118	2	213.19773	37.70227	36.80023	0.3524798	0.25037685	0.0915919	0.02363049	22.864826	25.70434
1339.99387	158.25809	84.76732	1.05486	0.13118	2	212.68121	38.21879	37.31676	0.3592302	0.25676463	0.0941795	0.02493866	23.547888	26.20835
1340.00628	158.7621	84.56599	1.05664	0.13118	2	212.17607	38.72393	37.82190	0.3658319	0.26304974	0.0967401	0.02626524	24.225662	26.71236
1339.99755	159.2661	84.36731	1.05811	0.13118	2	211.67758	39.22242	38.32038	0.3723466	0.26928871	0.0992963	0.0276212	24.904113	27.21636
1339.99032	159.77011	84.17058	1.05842	0.13118	2	211.18399	39.71601	38.81398	0.3787974	0.27550183	0.1018564	0.02901073	25.585426	27.72037
1340.00652	160.27412	83.97221	1.06048	0.13118	2	210.68627	40.21373	39.31169	0.3853502	0.28180198	0.1044674	0.03046012	26.282139	28.22438

APPENDIX 18: Data for the reactivity of China coke nuts at 1390^{o}C.

Temp./°C	Time/min	Mass/%	DTA/(mV/mg)	Sensit./(μV/mW)	Segment	mg change	mg evolved	CO evolved	%R	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1390.62365	137.23978	92.9358	0.94274	0.11585	2	232.99005	17.70995	16.72094	0	0	0	0	0	0
1390.81729	137.75378	92.49433	1.15724	0.11579	2	231.88329	18.81671	17.82770	0.0485955	0.00145562	0.00048544	7.067E-07	0.1019816	0.514
1390.44146	138.26779	92.04125	1.30583	0.1159	2	230.74741	19.95259	18.96357	0.0634551	0.00259016	0.00086413	2.239E-06	0.1815913	1.02801
1390.35539	138.78178	91.58141	1.33109	0.11593	2	229.59459	21.10541	20.11639	0.0785363	0.00410537	0.00137033	5.628E-06	0.2880797	1.54202
1390.26652	139.29578	91.11529	1.37011	0.11595	2	228.42603	22.27397	21.28496	0.0938236	0.00602828	0.00201348	1.215E-05	0.4234987	2.05602
1390.20194	139.80981	90.64201	1.4032	0.11597	2	227.23952	23.46048	22.47147	0.1093456	0.00839095	0.00280484	2.356E-05	0.5903125	2.57003
1390.15008	140.32382	90.1671	1.42881	0.11599	2	226.04892	24.65108	23.66207	0.1249211	0.01118751	0.00374317	4.193E-05	0.7883708	3.08404
1390.11532	140.83782	89.65766	1.44818	0.116	2	224.77175	25.92825	24.93923	0.1416291	0.01467201	0.00491479	7.223E-05	1.0360775	3.59804
1390.08652	141.35183	89.16668	1.46437	0.116	2	223.54087	27.15913	26.17012	0.1577317	0.0185142	0.00620988	0.0001152	1.310412	4.11205
1390.06089	141.86584	88.71364	1.47597	0.11601	2	222.40510	28.29490	27.30589	0.1725899	0.02248814	0.00755295	0.0001703	1.5954847	4.62606
1390.04184	142.37984	88.25662	1.48312	0.11602	2	221.25935	29.44065	28.45164	0.1875787	0.02692009	0.00905511	0.0002445	1.9150211	5.14006
1390.03659	142.89385	87.78476	1.4878	0.11602	2	220.07639	30.62361	29.63460	0.2030542	0.03194788	0.01076476	0.0003451	2.2795817	5.65407
1390.0254	143.40786	87.32137	1.48668	0.11602	2	218.91467	31.78533	30.79631	0.2182519	0.03733786	0.01260415	0.0004726	2.6728642	6.16808
1390.01977	143.92186	86.83256	1.48456	0.11602	2	217.68923	33.01077	32.02176	0.2342833	0.04351524	0.01472072	0.0006437	3.1267547	6.68208
1390.01612	144.43587	86.37058	1.47966	0.11603	2	216.53104	34.16896	33.17994	0.2494348	0.04982268	0.01689127	0.0008463	3.5937136	7.19609
1390.00188	144.94988	85.95174	1.47444	0.11603	2	215.48101	35.21899	34.22998	0.2631714	0.0559391	0.01900528	0.0010699	4.0499518	7.7101
1390.00692	145.46388	85.50112	1.46797	0.11603	2	214.35131	36.34869	35.35968	0.2779503	0.06294611	0.02143836	0.0013591	4.5768055	8.2241
1390.0224	145.97789	85.06308	1.46033	0.11602	2	213.25314	37.44686	36.45785	0.2923166	0.07018486	0.02396467	0.0016954	5.125827	8.73811
1390.068	146.4919	84.63642	1.45208	0.11603	2	212.18350	38.51650	37.52748	0.3063096	0.07764385	0.0265816	0.0020822	5.6966566	9.25212
1390.00432	147.0059	84.2131	1.44387	0.11603	2	211.12224	39.57776	38.58875	0.3201932	0.08544567	0.02933396	0.002531	6.299334	9.76612
1390.00383	147.51991	83.80196	1.43355	0.11603	2	210.09151	40.60849	39.61947	0.3336772	0.09340829	0.03215923	0.0030361	6.9204247	10.28013
1390.01093	148.03392	83.3995	1.42311	0.11603	2	209.08255	41.61745	40.62844	0.3468766	0.10157296	0.03507342	0.0036041	7.5636452	10.79414
1390.00449	148.54792	82.9975	1.41233	0.11603	2	208.07473	42.62527	41.63626	0.3600609	0.11009616	0.03813447	0.0042518	8.2420886	11.30814
1389.99808	149.06193	82.611	1.40105	0.11603	2	207.10578	43.59422	42.60521	0.3727369	0.11863946	0.04122242	0.0049578	8.9293864	11.82215
1390.00607	149.57594	82.22677	1.39002	0.11603	2	206.14251	44.55749	43.56848	0.3853384	0.12747334	0.04443646	0.0057483	9.6478145	12.33616
1390.00765	150.08994	81.85691	1.37742	0.11603	2	205.21527	45.48473	44.49572	0.3974686	0.13629947	0.04766942	0.0066005	10.373605	12.85016
1389.99195	150.60395	81.49449	1.36443	0.11603	2	204.30669	46.39331	45.40430	0.4093548	0.14525659	0.05097296	0.0075298	11.118463	13.36417
1389.99568	151.11796	81.13294	1.35167	0.11603	2	203.40028	47.29972	46.31071	0.4212125	0.15449795	0.05440561	0.0085578	11.895858	13.87818
1390.00985	151.63196	80.78536	1.33967	0.11603	2	202.52890	48.17110	47.18209	0.4326412	0.16367145	0.05783788	0.0096487	12.676632	14.39218
1390.00802	152.14597	80.44877	1.32788	0.11603	2	201.68507	49.01493	48.02592	0.4436511	0.17282626	0.06128827	0.0108083	13.464994	14.90619

1390.00294	152.65998	80.11647	1.31513	0.11603	2	200.85199	49.84801	48.85900	0.4545495	0.18212739	0.06481998	0.0120602	14.275505	15.4202
1389.99571	153.17398	79.79135	1.30312	0.11603	2	200.03691	50.66309	49.67407	0.4652123	0.19148143	0.06839888	0.0133952	15.100503	15.9342
1390.01265	153.68799	79.47831	1.28997	0.11603	2	199.25212	51.44788	50.45887	0.475479	0.20072607	0.07196316	0.0147907	15.925755	16.44821
1390.00865	154.202	79.16918	1.27846	0.11603	2	198.47713	52.22287	51.23385	0.4856175	0.21008536	0.07559975	0.0162818	16.771447	16.96222
1389.99906	154.716	78.86947	1.26621	0.11603	2	197.72576	52.97424	51.98523	0.495447	0.21937848	0.07923916	0.0178415	17.621505	17.47622
1390.00292	155.23001	78.57943	1.25449	0.11603	2	196.99863	53.70137	52.71236	0.5049594	0.22857777	0.08287039	0.0194643	18.473316	17.99023
1390.00498	155.74402	78.2959	1.2439	0.11603	2	196.28782	54.41218	53.42317	0.5142583	0.23776702	0.08652658	0.0211649	19.334654	18.50424
1389.99987	156.25802	78.0203	1.23343	0.11603	2	195.59689	55.10311	54.11410	0.5232971	0.24688594	0.09018397	0.0229325	20.19992	19.01824
1389.98872	156.77203	77.75125	1.22459	0.11603	2	194.92238	55.77762	54.78860	0.5321211	0.25596616	0.09385528	0.0247729	21.072121	19.53225
1390.00066	157.28604	77.49318	1.21386	0.11603	2	194.27540	56.42460	55.43559	0.5405849	0.26484153	0.09747275	0.0266506	21.935064	20.04626
1390.00758	157.80004	77.23839	1.20536	0.11603	2	193.63664	57.06336	56.07434	0.5489412	0.27376367	0.10113875	0.028618	22.81313	20.56026
1389.98564	158.31405	76.992	1.19883	0.11603	2	193.01894	57.68106	56.69204	0.557022	0.28254283	0.10477543	0.0306332	23.687669	21.07427
1390.00199	158.82806	76.75221	1.19021	0.11603	2	192.41779	58.28221	57.29320	0.5648864	0.29122988	0.10840327	0.0327061	24.56352	21.58828
1390.00211	159.34206	76.52165	1.18334	0.11603	2	191.83978	58.86022	57.87121	0.572448	0.29971592	0.1119759	0.0348078	25.429367	22.10228
1390.00307	159.85607	76.29633	1.17774	0.11603	2	191.27490	59.42510	58.43609	0.5798377	0.30813569	0.11554928	0.0369694	26.298663	22.61629
1389.99733	160.37008	76.07802	1.17046	0.11603	2	190.72760	59.97240	58.98339	0.5869976	0.31641312	0.11909061	0.0391697	27.163361	23.1303
1389.99552	160.88408	75.86288	1.16482	0.11603	2	190.18824	60.51176	59.52275	0.5940535	0.32468575	0.12265857	0.0414445	28.03775	23.6443
1390.01269	161.39809	75.65848	1.16054	0.11603	2	189.67581	61.02419	60.03518	0.6007572	0.33265172	0.12612191	0.0437078	28.889533	24.15831
1389.99597	161.9121	75.46413	1.1557	0.11603	2	189.18857	61.51143	60.52241	0.6071312	0.34032226	0.12948296	0.0459557	29.718987	24.67232

APPENDIX 19: Data for the reactivity of Vietnamese anthracite.

Temp./°C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(μV/mW)	Segment	mg change	mg evolved	CO evolved	%R		(T-900)oC	%R
898.75174	87.89799	98.35543	0.18597	0.25596	1	243.03627	4.06373	0	0		0	0
903.89476	88.41201	98.32926	0.18766	0.25491	1	242.97160	4.12840	0.064666	0.0008468		3.895	0.0008468
909.02432	88.92603	98.30273	0.18992	0.25385	1	242.90605	4.19395	0.130222	0.0017053		9.024	0.0017053
914.18055	89.44006	98.27357	0.19105	0.25277	1	242.83399	4.26601	0.202276	0.0026488		14.181	0.0026488
919.31678	89.95408	98.24461	0.19429	0.25168	1	242.76243	4.33757	0.273836	0.0035859		19.317	0.0035859
924.46977	90.4681	98.21522	0.19613	0.25057	1	242.68981	4.41019	0.346459	0.004537		24.470	0.004537
929.59874	90.98213	98.18276	0.19753	0.24946	1	242.60960	4.49040	0.426668	0.0055873		29.599	0.0055873
934.75585	91.49615	98.14955	0.19924	0.24833	1	242.52754	4.57246	0.508729	0.0066619		34.756	0.0066619
939.87568	92.01017	98.11818	0.20081	0.24719	1	242.45002	4.64998	0.586245	0.007677		39.876	0.007677
945.02795	92.5242	98.08293	0.20155	0.24603	1	242.36292	4.73708	0.673347	0.0088176		45.028	0.0088176
950.16854	93.03822	98.0479	0.20285	0.24486	1	242.27636	4.82364	0.759907	0.0099511		50.169	0.0099511
955.31258	93.55224	98.01587	0.2046	0.24368	1	242.19721	4.90279	0.839053	0.0109876		55.313	0.0109876
960.43662	94.06627	97.97672	0.20659	0.24249	1	242.10048	4.99952	0.935792	0.0122544		60.437	0.0122544
965.60915	94.58029	97.94008	0.20788	0.24128	1	242.00994	5.09006	1.026330	0.01344		65.609	0.01344
970.73526	95.09431	97.90404	0.21029	0.24006	1	241.92088	5.17912	1.115385	0.0146062		70.735	0.0146062
975.88466	95.60834	97.86912	0.21164	0.23882	1	241.83460	5.26540	1.201672	0.0157361		75.885	0.0157361
981.055	96.12236	97.83394	0.21345	0.23757	1	241.74767	5.35233	1.288602	0.0168745		81.055	0.0168745
986.17699	96.63638	97.79868	0.2157	0.23632	1	241.66054	5.43946	1.375729	0.0180155		86.177	0.0180155
991.33703	97.15041	97.76767	0.2169	0.23504	1	241.58391	5.51609	1.452355	0.0190189		91.337	0.0190189
996.48337	97.66443	97.73364	0.21921	0.23376	1	241.49982	5.60018	1.536443	0.02012		96.483	0.02012
1001.65637	98.17845	97.70307	0.22114	0.23246	1	241.42429	5.67571	1.611982	0.0211092		101.656	0.0211092
1006.77561	98.69248	97.6762	0.2235	0.23116	1	241.35789	5.74211	1.678377	0.0219787		106.776	0.0219787
1011.91096	99.2065	97.64966	0.22504	0.22984	1	241.29231	5.80769	1.743958	0.0228375		111.911	0.0228375
1017.07137	99.72052	97.62276	0.2267	0.2285	1	241.22584	5.87416	1.810428	0.0237079		117.071	0.0237079
1022.21577	100.23455	97.59916	0.22864	0.22716	1	241.16752	5.93248	1.868743	0.0244716		122.216	0.0244716
1027.36171	100.74857	97.5742	0.22917	0.22581	1	241.10585	5.99415	1.930419	0.0252792		127.362	0.0252792
1032.50423	101.26259	97.55218	0.2307	0.22445	1	241.05144	6.04856	1.984831	0.0259918		132.504	0.0259918
1037.6481	101.77662	97.52977	0.23177	0.22307	1	240.99606	6.10394	2.040206	0.0267169		137.648	0.0267169
1042.79266	102.29064	97.50702	0.23287	0.22168	1	240.93985	6.16015	2.096421	0.0274531		142.793	0.0274531
1047.92116	102.80466	97.48612	0.23257	0.22029	1	240.88820	6.21180	2.148065	0.0281293		147.921	0.0281293
1053.06113	103.31869	97.46578	0.23276	0.21888	1	240.83794	6.26206	2.198325	0.0287875		153.061	0.0287875
1058.2039	103.83271	97.44738	0.23252	0.21747	1	240.79248	6.30752	2.243792	0.0293829		158.204	0.0293829
1063.3427	104.34673	97.42684	0.23141	0.21604	1	240.74172	6.35828	2.294546	0.03004		163.343	0.0300475

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1068.48549	104.86076	97.40752	0.23077	0.2146	1	240.69398	6.40602	2.342286	0.0306727		168.485	0.0306727
1073.6214	105.37478	97.38899	0.22886	0.21315	1	240.64819	6.45181	2.388073	0.0312723		173.621	0.0312723
1078.77004	105.8888	97.37206	0.22641	0.2117	1	240.60636	6.49364	2.429907	0.0318201		178.770	0.0318201
1083.90286	106.40283	97.35717	0.22654	0.21023	1	240.56957	6.53043	2.466700	0.0323019		183.903	0.0323019
1089.05547	106.91685	97.34377	0.22574	0.20875	1	240.53646	6.56354	2.499812	0.0327355		189.055	0.0327355
1094.18663	107.43087	97.32898	0.2237	0.20727	1	240.49991	6.60009	2.536358	0.0332141		194.187	0.0332141
1099.3361	107.9449	97.31339	0.22287	0.20578	1	240.46139	6.63861	2.574881	0.0337186		199.336	0.0337186
1104.48033	108.45892	97.30154	0.22201	0.20427	1	240.43211	6.66789	2.604162	0.034102		204.480	0.034102
1109.61612	108.97294	97.28593	0.22133	0.20277	1	240.39353	6.70647	2.642735	0.0346071		209.616	0.0346071
1114.76216	109.48697	97.27416	0.22154	0.20125	1	240.36445	6.73555	2.671818	0.034988		214.762	0.034988
1119.89215	110.00099	97.25943	0.2209	0.19973	1	240.32805	6.77195	2.708216	0.0354646		219.892	0.0354646
1125.0356	110.51501	97.24602	0.21944	0.19819	1	240.29492	6.80508	2.741352	0.0358986		225.036	0.0358986
1130.15947	111.02904	97.23119	0.21981	0.19666	1	240.25827	6.84173	2.777997	0.0363784		230.159	0.0363784
1135.32043	111.54306	97.21872	0.21887	0.19511	1	240.22746	6.87254	2.808810	0.0367819		235.320	0.0367819
1140.45134	112.05708	97.20525	0.21912	0.19356	1	240.19417	6.90583	2.842095	0.0372178		240.451	0.0372178

APPENDIX 20: Data for the reactivity of Vietnamese anthracite at 1190^{o}C.

Temp./-C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(µV/mW)	Segment	mg change	mg evolved	CO evolved	%R	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1188.38726	116.84212	96.91689	0.38806	0.17881	1	241.22614	7.67386	3.34459	0	0	0	0	0	0
1190.99293	117.31516	96.89893	0.39851	0.178	2	241.18144	7.71856	3.38930	0.0033193	0.000134826	4.494E-05	6.06E-09	0.2230385	0.47304
1191.74938	117.78821	96.87588	0.55758	0.17776	2	241.12407	7.77593	3.44667	0.0040679	0.000829585	0.0002766	2.295E-07	1.392048	0.94609
1191.13201	118.26125	96.85937	0.68526	0.17796	2	241.08297	7.81703	3.48776	0.0046042	0.001327219	0.0004426	5.875E-07	2.2496566	1.41913
1190.98109	118.7343	96.84244	0.69673	0.178	2	241.04083	7.85917	3.52990	0.0051541	0.001837513	0.0006129	1.126E-06	3.1466769	1.89218
1190.84893	119.20734	96.82795	0.7004	0.17804	2	241.00477	7.89523	3.56597	0.0056247	0.002274261	0.0007587	1.726E-06	3.9285746	2.36522
1190.75292	119.68039	96.81307	0.70708	0.17807	2	240.96773	7.93227	3.60300	0.006108	0.002722765	0.0009084	2.474E-06	4.7451168	2.83827
1190.63161	120.15343	96.79923	0.71301	0.17811	2	240.93328	7.96672	3.63745	0.0065575	0.003139922	0.0010477	3.291E-06	5.516965	3.31131
1190.54622	120.62648	96.78728	0.71764	0.17814	2	240.90354	7.99646	3.66719	0.0069456	0.003500112	0.0011681	4.09E-06	6.1930104	3.78436
1190.47401	121.09952	96.77531	0.72288	0.17816	2	240.87375	8.02625	3.69699	0.0073344	0.003860904	0.0012886	4.977E-06	6.8791117	4.2574
1190.39295	121.57257	96.76391	0.72809	0.17819	2	240.84537	8.05463	3.72536	0.0077047	0.004204516	0.0014035	5.904E-06	7.5408496	4.73045
1190.3312	122.04561	96.75257	0.73369	0.17821	2	240.81715	8.08285	3.75359	0.008073	0.004546319	0.0015177	6.904E-06	8.2071499	5.20349
1190.2948	122.51866	96.74033	0.73826	0.17822	2	240.78668	8.11332	3.78405	0.0084706	0.00491525	0.0016411	8.071E-06	8.9353402	5.67654
1190.25193	122.9917	96.72969	0.74345	0.17823	2	240.76020	8.13980	3.81053	0.0088162	0.005235954	0.0017484	9.16E-06	9.5759444	6.14958
1190.20118	123.46475	96.7202	0.74954	0.17825	2	240.73658	8.16342	3.83416	0.0091244	0.005521996	0.0018441	1.019E-05	10.153279	6.62263
1190.17604	123.93779	96.71161	0.75406	0.17825	2	240.71520	8.18480	3.85554	0.0094034	0.00578091	0.0019307	1.117E-05	10.680714	7.09567
1190.15628	124.41084	96.70269	0.75988	0.17826	2	240.69300	8.20700	3.87774	0.0096931	0.006049771	0.0020207	1.223E-05	11.233296	7.56872
1190.12725	124.88388	96.69281	0.76536	0.17827	2	240.66840	8.23160	3.90233	0.010014	0.006347568	0.0021203	1.347E-05	11.851157	8.04176
1190.10362	125.35693	96.68406	0.76947	0.17828	2	240.64663	8.25337	3.92411	0.0102982	0.006611305	0.0022086	1.461E-05	12.403453	8.51481
1190.09384	125.82997	96.67431	0.77502	0.17828	2	240.62236	8.27764	3.94838	0.0106149	0.006905184	0.002307	1.594E-05	13.024514	8.98785
1190.06997	126.30302	96.66524	0.78112	0.17829	2	240.59978	8.30022	3.97095	0.0109095	0.007178566	0.0023986	1.723E-05	13.607605	9.4609
1190.06011	126.77606	96.6562	0.78608	0.17829	2	240.57728	8.32272	3.99345	0.0112031	0.007451044	0.0024899	1.857E-05	14.193895	9.93394
1190.0485	127.24911	96.64711	0.79089	0.17829	2	240.55466	8.34534	4.01608	0.0114984	0.00772503	0.0025817	1.996E-05	14.788593	10.40699
1190.0384	127.72215	96.63939	0.79578	0.1783	2	240.53544	8.36456	4.03529	0.0117491	0.007957721	0.0026596	2.118E-05	15.297728	10.88003
1190.03001	128.1952	96.63142	0.80166	0.1783	2	240.51560	8.38440	4.05513	0.012008	0.008197948	0.0027402	2.248E-05	15.827272	11.35308
1190.01486	128.66824	96.62351	0.80685	0.1783	2	240.49592	8.40408	4.07482	0.0122649	0.008436366	0.0028201	2.381E-05	16.35677	11.82612
1190.03245	129.14129	96.61561	0.81073	0.1783	2	240.47625	8.42375	4.09448	0.0125215	0.008674483	0.0028999	2.518E-05	16.889517	12.29917
1190.01708	129.61433	96.60761	0.81659	0.1783	2	240.45634	8.44366	4.11439	0.0127813	0.008915614	0.0029807	2.66E-05	17.433001	12.77221
1189.99956	130.08738	96.60003	0.82179	0.17831	2	240.43747	8.46253	4.13326	0.0130275	0.009144086	0.0030574	2.799E-05	17.951659	13.24526
1190.00546	130.56042	96.59395	0.82718	0.17831	2	240.42234	8.47766	4.14839	0.013225	0.009327346	0.0031188	2.912E-05	18.370289	13.7183
1190.00901	131.03347	96.58722	0.83209	0.17831	2	240.40559	8.49441	4.16514	0.0134436	0.009530197	0.0031869	3.04E-05	18.836382	14.19135

1190.00515	131.50651	96.57926	0.83736	0.17831	2	240.38578	8.51422	4.18495	0.0137021	0.009770123	0.0032674	3.196E-05	19.391335	14.66439
1189.99733	131.97956	96.57243	0.8431	0.17831	2	240.36878	8.53122	4.20195	0.013924	0.009975988	0.0033364	3.332E-05	19.870682	15.13744
1190.00796	132.45526	96.56597	0.84846	0.17831	2	240.35270	8.54730	4.21803	0.0141338	0.010170702	0.0034018	3.464E-05	20.326761	15.61048
1190.00109	132.92565	96.55891	0.85383	0.17831	2	240.33513	8.56487	4.23561	0.0143631	0.0103835	0.0034732	3.611E-05	20.828202	16.08353
1190.00095	133.39869	96.55255	0.85893	0.17831	2	240.31930	8.58070	4.25144	0.0145697	0.010575199	0.0035376	3.745E-05	21.28261	16.55657
1189.98291	133.87174	96.54536	0.86462	0.17831	2	240.30140	8.59860	4.26933	0.0148032	0.010791915	0.0036103	3.901E-05	21.799386	17.02962
1189.98907	134.34478	96.5382	0.87002	0.17831	2	240.28358	8.61642	4.28715	0.0150357	0.011007728	0.0036828	4.059E-05	22.31724	17.50266
1189.99192	134.81783	96.53124	0.8753	0.17831	2	240.26626	8.63374	4.30448	0.0152618	0.011217512	0.0037532	4.215E-05	22.823723	17.97571
1189.98964	135.29087	96.5257	0.88061	0.17831	2	240.25247	8.64753	4.31827	0.0154417	0.011384495	0.0038093	4.342E-05	23.229053	18.44875
1189.99198	135.76392	96.51939	0.88541	0.17831	2	240.23676	8.66324	4.33397	0.0156467	0.011574687	0.0038732	4.489E-05	23.693075	18.9218
1190.00415	136.23696	96.51379	0.88983	0.17831	2	240.22282	8.67718	4.34791	0.0158286	0.011743479	0.0039299	4.621E-05	24.106987	19.39484
1189.99436	136.71001	96.50665	0.89538	0.17831	2	240.20505	8.69495	4.36568	0.0160605	0.011958689	0.0040022	4.793E-05	24.637591	19.86789
1189.99459	137.18305	96.50118	0.90081	0.17831	2	240.19144	8.70856	4.37930	0.0162382	0.012123562	0.0040576	4.926E-05	25.046265	20.34093
1190.00577	137.6561	96.49561	0.90613	0.17831	2	240.17757	8.72243	4.39316	0.0164191	0.012291449	0.0041141	5.064E-05	25.46435	20.81398
1189.98696	138.12914	96.48925	0.91231	0.17831	2	240.16174	8.73826	4.40899	0.0166256	0.012483149	0.0041785	5.223E-05	25.944125	21.28702
1189.99597	138.60219	96.48213	0.91714	0.17831	2	240.14402	8.75598	4.42671	0.0168569	0.012697755	0.0042506	5.405E-05	26.48426	21.76007
1189.99493	139.07523	96.47658	0.92266	0.17831	2	240.13021	8.76979	4.44053	0.0170372	0.01286504	0.0043069	5.549E-05	26.907511	22.23311
1190.0067	139.54828	96.47105	0.92763	0.17831	2	240.11644	8.78356	4.45429	0.0172168	0.013031722	0.0043629	5.694E-05	27.331172	22.70616
1190.00266	140.02132	96.46472	0.93301	0.17831	2	240.10069	8.79931	4.47004	0.0174224	0.013222517	0.0044271	5.862E-05	27.818491	23.1792
1189.98891	140.49437	96.45913	0.9381	0.17831	2	240.08677	8.81323	4.48396	0.0176039	0.013391007	0.0044837	6.013E-05	28.250945	23.65225
1190.00163	140.96741	96.4543	0.94331	0.17831	2	240.07475	8.82525	4.49598	0.0177608	0.01353659	0.0045327	6.145E-05	28.626194	24.12529

APPENDIX 21: Data for the reactivity of Vietnamese anthracite at 1240^{o}C.

Temp./-C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(μV/mW)	Segment	mg change	mg evolved	CO evolved	%R	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1240.37961	122.21081	96.43451	0.38559	0.16246	2	239.4468883	8.85311167	4.15346308	0	0	0	0	0	0
1241.63232	122.69385	96.38862	0.52434	0.16206	2	239.3329435	8.96705654	4.26740795	0.0035591	0.003559087	0.0011878	4.229E-06	3.377358	0.48304
1240.94101	123.17769	96.36138	0.65651	0.16228	2	239.2653065	9.03469346	4.33504487	0.0044417	0.004441708	0.0014828	6.589E-06	4.216685	0.96609
1240.82388	123.65995	96.33343	0.66199	0.16232	2	239.1959067	9.10409331	4.40444472	0.0053473	0.005347334	0.0017856	9.554E-06	5.0786234	1.44914
1240.69251	124.14299	96.30425	0.67712	0.16236	2	239.1234528	9.17654725	4.47689866	0.0062928	0.006292814	0.002102	1.324E-05	5.9792883	1.93218
1240.5892	124.62604	96.2793	0.68511	0.16239	2	239.0615019	9.2384981	4.53884951	0.0071012	0.007101235	0.0023727	1.686E-05	6.7500357	2.41523
1240.48934	125.10909	96.25621	0.69018	0.16243	2	239.0041694	9.29583057	4.59618198	0.0078494	0.007849389	0.0026233	2.061E-05	7.463855	2.89828
1240.41955	125.59213	96.23212	0.69345	0.16245	2	238.944354	9.35564604	4.65599745	0.0086299	0.008629944	0.002885	2.492E-05	8.2091331	3.38132
1240.34485	126.07518	96.21085	0.69879	0.16247	2	238.8915406	9.40845945	4.70881086	0.0093191	0.009319127	0.0031161	2.907E-05	8.8676307	3.86437
1240.28806	126.55823	96.19067	0.70404	0.16249	2	238.8414336	9.45856639	4.7589178	0.009973	0.009972992	0.0033354	3.33E-05	9.4927845	4.34742
1240.24606	127.04127	96.17082	0.70872	0.1625	2	238.7921461	9.50785394	4.80820535	0.0106162	0.010616165	0.0035513	3.775E-05	10.108097	4.83046
1240.20523	127.52432	96.15131	0.71408	0.16252	2	238.7437027	9.55629727	4.85664868	0.0112483	0.011248321	0.0037636	4.239E-05	10.713239	5.31351
1240.15881	128.00737	96.13535	0.71856	0.16253	2	238.7040741	9.59592595	4.89627736	0.0117655	0.011765451	0.0039373	4.638E-05	11.208544	5.79656
1240.12602	128.49041	96.1183	0.72304	0.16254	2	238.6617389	9.6382611	4.93861251	0.0123179	0.012317899	0.0041229	5.086E-05	11.737946	6.2796
1240.10664	128.97346	96.10003	0.72751	0.16255	2	238.6163745	9.68362551	4.98397692	0.0129099	0.012909877	0.0043219	5.588E-05	12.305541	6.76265
1240.09095	129.45651	96.08391	0.73196	0.16255	2	238.5763485	9.72365147	5.02400288	0.0134322	0.013432192	0.0044976	6.05E-05	12.806609	7.2457
1240.08924	129.93955	96.0665	0.73683	0.16255	2	238.5331195	9.7668805	5.06723191	0.0139963	0.013996305	0.0046874	6.571E-05	13.348057	7.72874
1240.07301	130.4226	96.05047	0.74141	0.16256	2	238.493317	9.80668299	5.1070344	0.0145157	0.014515703	0.0048622	7.069E-05	13.846847	8.21179
1240.05858	130.90565	96.03486	0.74564	0.16256	2	238.4545574	9.84544262	5.14579403	0.0150215	0.015021493	0.0050324	7.572E-05	14.332807	8.69484
1240.03562	131.38869	96.0183	0.75062	0.16257	2	238.4134389	9.8865611	5.18691251	0.0155581	0.015558064	0.0052132	8.125E-05	14.848599	9.17788
1240.03455	131.87174	96.00587	0.75556	0.16257	2	238.3825752	9.91742479	5.2177762	0.0159608	0.015960816	0.0053488	8.552E-05	15.23593	9.66093
1240.03145	132.35479	95.9827	0.76012	0.16257	2	238.3250441	9.97495599	5.27530731	0.0167116	0.016711562	0.0056018	9.379E-05	15.958329	10.14398
1240.01084	132.83783	95.96921	0.76573	0.16258	2	238.2915484	10.00845157	5.30880298	0.0171487	0.017148661	0.0057492	9.878E-05	16.379163	10.62702
1240.01032	133.32088	95.96246	0.7715	0.16258	2	238.2747882	10.02521182	5.32556323	0.0173674	0.017367372	0.005823	0.0001013	16.589802	11.11007
1240.00489	133.80393	95.94652	0.77578	0.16258	2	238.2352092	10.06479084	5.36514225	0.0178839	0.017883854	0.0059972	0.0001075	17.087399	11.59312
1239.9989	134.28697	95.93213	0.78111	0.16258	2	238.1994788	10.10052121	5.40087262	0.0183501	0.018350114	0.0061545	0.0001132	17.536822	12.07616
1240.00432	134.77002	95.91907	0.78619	0.16258	2	238.1670508	10.13294919	5.43330061	0.0187733	0.018773279	0.0062973	0.0001185	17.944882	12.55921
1239.99766	135.25307	95.9055	0.79115	0.16258	2	238.1333565	10.16664635	5.46699491	0.019213	0.019212969	0.0064458	0.0001241	18.369052	13.04226
1239.9905	135.73611	95.89234	0.79576	0.16258	2	238.1006802	10.19931978	5.49967119	0.0196394	0.019639375	0.0065898	0.0001297	18.780579	13.5253
1239.99258	136.21916	95.87839	0.80072	0.16258	2	238.0660424	10.23395763	5.53430904	0.0200914	0.020091378	0.0067425	0.0001358	19.216993	14.00835
1239.99288	136.70221	95.86399	0.80589	0.16258	2	238.0302872	10.26971283	5.57006424	0.020558	0.020557962	0.0069002	0.0001422	19.667685	14.4914

1240.00421	137.18525	95.85135	0.81052	0.16258	2	237.9989021	10.30109795	5.60144936	0.0209675	0.020967518	0.0070386	0.0001479	20.06346	14.97444
1240.00478	137.6683	95.83935	0.81534	0.16258	2	237.9691061	10.33089395	5.63124536	0.0213563	0.021356338	0.0071701	0.0001535	20.43934	15.45749
1239.9921	138.15135	95.82673	0.82119	0.16258	2	237.9377706	10.36222941	5.66258082	0.0217652	0.021765247	0.0073084	0.0001595	20.834792	15.94054
1239.98357	138.63439	95.8131	0.82618	0.16259	2	237.9039273	10.3960727	5.69642411	0.0222069	0.022206881	0.0074578	0.000166	21.262068	16.42358
1240.00582	139.11744	95.79973	0.83027	0.16258	2	237.8707296	10.42927041	5.72962182	0.0226401	0.022640091	0.0076044	0.0001726	21.68137	16.90663
1240.00273	139.60049	95.78741	0.83573	0.16258	2	237.8401039	10.45986097	5.76021238	0.0230393	0.02303928	0.0077395	0.0001788	22.067898	17.38968
1239.99421	140.08353	95.77523	0.84035	0.16258	2	237.8098961	10.49010391	5.79045532	0.0234339	0.023433932	0.0078731	0.000185	22.45018	17.87272
1239.99181	140.56658	95.76329	0.84499	0.16258	2	237.7802491	10.51975093	5.82010234	0.0238208	0.023820807	0.0080042	0.0001912	22.825071	18.35577
1239.99095	141.04963	95.74975	0.85052	0.16258	2	237.7466293	10.55337075	5.85372216	0.0242595	0.024259526	0.0081528	0.0001983	23.250368	18.83882
1240.00337	141.53267	95.73754	0.85606	0.16258	2	237.7163118	10.58368818	5.88403959	0.0246551	0.02465515	0.0082869	0.0002049	23.634043	19.32186
1239.99824	142.01572	95.72657	0.86051	0.16258	2	237.6890733	10.61092669	5.9112781	0.0250106	0.025010596	0.0084074	0.0002109	23.978879	19.80491
1239.99583	142.49877	95.71392	0.86501	0.16258	2	237.6576634	10.64233664	5.94268805	0.0254205	0.025420477	0.0085463	0.0002179	24.376672	20.28796
1240.00125	142.98181	95.70145	0.87011	0.16258	2	237.6267004	10.67329965	5.97365106	0.0258245	0.025824525	0.0086834	0.0002249	24.768959	20.771
1239.99138	143.46486	95.68936	0.87507	0.16258	2	237.5966809	10.70331912	6.00367053	0.0262163	0.026216261	0.0088163	0.0002318	25.149437	21.25405
1239.99751	143.94791	95.67719	0.87977	0.16258	2	237.5664628	10.73353723	6.03388864	0.0266106	0.026610589	0.0089501	0.0002389	25.532579	21.7371
1239.99538	144.43095	95.66503	0.88416	0.16258	2	237.5362695	10.76373051	6.06408192	0.0270046	0.027004593	0.0090838	0.000246	25.915553	22.22014
1239.9871	144.914	95.65289	0.88935	0.16258	2	237.5061259	10.79387413	6.09422554	0.0273979	0.027397949	0.0092173	0.0002533	26.298041	22.70319
1239.99842	145.39705	95.64066	0.89432	0.16258	2	237.4757588	10.82424122	6.12459263	0.0277942	0.027794221	0.0093519	0.0002607	26.683513	23.18624
1240.01175	145.88009	95.62909	0.89825	0.16258	2	237.4470305	10.85296953	6.15332094	0.0281691	0.028169108	0.0094793	0.0002679	27.048319	23.66928
1240.00416	146.36314	95.61791	0.90374	0.16258	2	237.4192705	10.88072947	6.18108088	0.0285314	0.028531358	0.0096024	0.0002748	27.400953	24.15233
1239.9979	146.84619	95.60576	0.90853	0.16258	2	237.3891021	10.91089792	6.21124933	0.028925	0.028925038	0.0097362	0.0002825	27.784323	24.63538
1240.01113	147.32923	95.59448	0.91327	0.16258	2	237.3610938	10.93890616	6.23925757	0.0292905	0.029290529	0.0098604	0.0002898	28.140373	25.11842
1239.99367	147.81228	95.58107	0.9185	0.16258	2	237.3277968	10.97220319	6.272554	0.029725	0.029725035	0.0100082	0.0002985	28.56382	25.60147
1239.99468	148.29533	95.56851	0.92426	0.16258	2	237.2966103	11.00338967	6.30374108	0.030132	0.030132	0.0101466	0.0003068	28.960588	26.08452
1239.9823	148.77837	95.5563	0.92861	0.16259	2	237.2662929	11.03370771	6.33405851	0.0305276	0.030527624	0.0102812	0.0003149	29.34645	26.56756
1239.99646	149.26142	95.54551	0.93242	0.16258	2	237.2395013	11.06049867	6.36085008	0.0308772	0.030877237	0.0104002	0.0003222	29.687559	27.05061

APPENDIX 22: Data for the reactivity of Vietnamese anthracite at 1290^{o}C.

Temp./-C	Time/min	Mass/%	DTA/(mW/mg)	Sensit./(mV/mW)	Segment	mg change	mg evolved	CO evolved	%R	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1289.57904	126.95971	96.11736	0.32687	0.14691	1	239.13999	9.66001	5.27993	0	0	0	0	0	0
1291.32882	127.45372	96.05549	0.36335	0.14636	2	238.98606	9.81394	5.43387	0.0001533	0.003315929	0.0011065	3.671E-06	0.4298384	0.49401
1290.94088	127.94772	96.00257	0.57647	0.14648	2	238.85439	9.94561	5.56553	0.0018646	0.016822163	0.0056391	9.504E-05	2.1941117	0.98801
1290.71532	128.44173	95.95193	0.62424	0.14656	2	238.72840	10.07160	5.69152	0.0035022	0.025340 8	0.0085193	0.0002165	3.318157	1.48202
1290.59819	128.93574	95.90228	0.62502	0.14659	2	238.60487	10.19513	5.81505	0.0051077	0.032385384	0.0109138	0.0003547	4.2543968	1.97603
1290.49978	129.42974	95.85366	0.63079	0.14662	2	238.48391	10.31609	5.93602	0.00668	0.038557132	0.0130212	0.0005042	5.0796772	2.47003
1290.40278	129.92375	95.8099	0.63713	0.14666	2	238.37503	10.42497	6.04489	0.0080951	0.043686197	0.0147794	0.0006488	5.7691498	2.96404
1290.32217	130.41776	95.76524	0.64274	0.14668	2	238.26392	10.53608	6.15601	0.0095393	0.048605508	0.0164717	0.000805	6.4335402	3.45805
1290.25474	130.91176	95.72244	0.64638	0.1467	2	238.15743	10.64257	6.26250	0.0109233	0.053080 02	0.0180 16	0.000962	7.0405263	3.95205
1290.221	131.40577	95.68025	0.65167	0.14671	2	238.05246	10.74754	6.36746	0.0122877	0.057300061	0.0194769	0.0011233	7.6153399	4.44606
1290.18177	131.89978	95.63813	0.65791	0.14672	2	237.94767	10.85233	6.47226	0.0136497	0.061352255	0.0208839	0.0012902	8.1694511	4.94007
1290.15999	132.39378	95.59705	0.663	0.14673	2	237.84546	10.95454	6.57447	0.0149782	0.065170024	0.0222131	0.0014583	8.6934554	5.43407
1290.11744	132.88779	95.55632	0.66954	0.14674	2	237.74412	11.05588	6.67580	0.0162953	0.068839 85	0.0234943	0.00163	9.1989482	5.92808
1290.09523	133.3818	95.51516	0.67497	0.14675	2	237.64172	11.15828	6.77821	0.0176263	0.072444336	0.0247559	0.0018082	9.6971637	6.42209
1290.06873	133.8758	95.47431	0.68132	0.14676	2	237.54008	11.25992	6.87984	0.0189473	0.075928591	0.0259786	0.0019896	10.180394	6.91609
1290.06196	134.36981	95.43371	0.68618	0.14676	2	237.43907	11.36093	6.98086	0.0202602	0.079308205	0.0271675	0.0021741	10.650654	7.4101
1290.04217	134.86382	95.39456	0.69271	0.14677	2	237.34167	11.45833	7.07826	0.0215262	0.082495 21	0.0282913	0.0023559	11.095513	7.90411
1290.0376	135.35782	95.35373	0.69922	0.14677	2	237.24008	11.55992	7.17985	0.0228465	0.085749833	0.0294416	0.0025494	11.551221	8.39811
1290.02339	135.85183	95.31342	0.70529	0.14677	2	237.13979	11.66021	7.28014	0.0241501	0.088899014	0.0305572	0.0027442	11.993528	8.89212
1290.02646	136.34584	95.27208	0.71227	0.14677	2	237.03694	11.76306	7.38299	0.0254869	0.092067451	0.0316823	0.0029477	12.439902	9.38613
1290.01498	136.83984	95.23002	0.71781	0.14678	2	236.93229	11.86771	7.48764	0.026847	0.095231913	0.0328086	0.0031586	12.887087	9.88013
1290.00157	137.33385	95.18929	0.72269	0.14678	2	236.83095	11.96905	7.58897	0.0281641	0.098243241	0.0338828	0.0033663	13.31391	10.37414
1290.01438	137.82786	95.14817	0.72874	0.14678	2	236.72865	12.07135	7.69128	0.0294939	0.101233798	0.034952	0.0035795	13.739029	10.86815
1290.01617	138.32186	95.10446	0.73446	0.14678	2	236.61990	12.18010	7.80003	0.0309073	0.104361428	0.0360727	0.0038098	14.184964	11.36215
1290.00116	138.81587	95.06277	0.74063	0.14678	2	236.51617	12.28383	7.90375	0.0322555	0.107298183	0.0371274	0.004033	14.604929	11.85616
1290.00301	139.30988	95.02097	0.7458	0.14678	2	236.41217	12.38783	8.00775	0.0336072	0.110199856	0.0381718	0.00426	15.021067	12.35017
1290.00858	139.80388	94.97754	0.75163	0.14678	2	236.30412	12.49588	8.11581	0.0350116	0.113171733	0.0392438	0.0044994	15.448505	12.84417
1290.00682	140.29789	94.93568	0.75742	0.14678	2	236.19997	12.60003	8.21995	0.0363653	0.115996925	0.0402652	0.0047333	15.856008	13.33818
1289.99774	140.7919	94.89468	0.76215	0.14678	2	236.09796	12.70204	8.32196	0.0376911	0.118728604	0.0412548	0.0049654	16.251106	13.83219
1290.00493	141.28591	94.85126	0.76673	0.14678	2	235.98993	12.81007	8.42999	0.0390952	0.121585 1	0.0422917	0.0052145	16.665401	14.32619
1290.01103	141.77991	94.8085	0.77242	0.14678	2	235.88355	12.91645	8.53638	0.040478	0.124363286	0.0433025	0.0054629	17.069466	14.8202

1290.00296	142.27392	94.76726	0.77759	0.14678	2	235.78094	13.01906	8.63898	0.0418116	0.127011413	0.0442679	0.0057054	17.455656	15.31421
1290.00463	142.76792	94.72435	0.78322	0.14678	2	235.67418	13.12582	8.74574	0.0431992	0.129735578	0.045263	0.0059608	17.853999	15.80821
1290.0127	143.26193	94.68279	0.78744	0.14678	2	235.57078	13.22922	8.84914	0.0445431	0.132344987	0.0462182	0.0062109	18.23658	16.30222
1290.00564	143.75594	94.64073	0.79297	0.14678	2	235.46614	13.33386	8.95379	0.0459033	0.134957881	0.0471766	0.0064669	18.620675	16.79623
1289.99264	144.24994	94.5985	0.7994	0.14678	2	235.36107	13.43893	9.05886	0.0472689	0.137554212	0.0481308	0.0067267	19.003333	17.29023
1290.01155	144.74395	94.55634	0.80379	0.14678	2	235.25617	13.54383	9.16375	0.0486322	0.140120179	0.0490758	0.0069889	19.382498	17.78424
1290.00604	145.23796	94.51333	0.80904	0.14678	2	235.14917	13.65083	9.27076	0.0500231	0.142712064	0.0500322	0.0072592	19.76649	18.27825
1290.00908	145.73196	94.47114	0.81433	0.14678	2	235.04420	13.75580	9.37573	0.0513874	0.145230138	0.0509632	0.007527	20.14051	18.77225
1290.00457	146.22597	94.42978	0.81903	0.14678	2	234.94129	13.85871	9.47863	0.0527249	0.147676058	0.0518693	0.0077922	20.504726	19.26626
1289.99558	146.71998	94.38843	0.82372	0.14678	2	234.83841	13.96159	9.58151	0.054062	0.150099772	0.0527688	0.0080598	20.866527	19.76027
1289.99929	147.21398	94.34692	0.82967	0.14678	2	234.73514	14.06486	9.68479	0.0554044	0.15251185	0.0536658	0.0083309	21.227477	20.25427
1290.00751	147.70799	94.30398	0.83528	0.14678	2	234.62830	14.17170	9.79162	0.0567929	0.154985596	0.0545874	0.008614	21.598576	20.74828
1290.00067	148.202	94.26265	0.83999	0.14678	2	234.52547	14.27453	9.89445	0.0581295	0.157346673	0.0554688	0.008889	21.953648	21.24229
1290.00515	148.696	94.22038	0.84614	0.14678	2	234.42031	14.37969	9.99962	0.0594964	0.159741877	0.0563646	0.0091728	22.314729	21.73629
1289.99353	149.19001	94.17807	0.85163	0.14678	2	234.31504	14.48496	10.10489	0.0608646	0.162120137	0.0572557	0.0094593	22.674133	22.2303
1290.00386	149.68402	94.13497	0.85695	0.14678	2	234.20781	14.59219	10.21212	0.0622583	0.16452364	0.058158	0.0097536	23.038245	22.72431
1289.99902	150.17802	94.09197	0.86223	0.14678	2	234.10082	14.69918	10.31910	0.0636488	0.166902872	0.0590529	0.0100499	23.399566	23.21831
1290.00143	150.67203	94.04892	0.86819	0.14678	2	233.99371	14.80629	10.42621	0.065041	0.169266714	0.0599437	0.010349	23.759429	23.71232
1290.00147	151.16604	94.00409	0.87372	0.14678	2	233.88218	14.91782	10.53775	0.0664907	0.171709548	0.060866	0.010663	24.132242	24.20633
1289.99362	151.66004	93.9583	0.87938	0.14678	2	233.76825	15.03175	10.65168	0.0679714	0.174185525	0.0618027	0.0109866	24.511076	24.70033
1290.00063	152.15405	93.91496	0.88456	0.14678	2	233.66042	15.13958	10.75951	0.0693729	0.17651169	0.0626845	0.0112954	24.867875	25.19434

APPENDIX 23: Data for the reactivity of Vietnamese anthracite at 1340^{o}C.

mp./-C	Time/ min	Mass/ %	DTA/(mW /mg)	Sensit./(µ V/mW)	Segm ent	mg change	mg evolved	CO evolved	%R	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1340.90469	132.30654	95.20179	-1.48216	0.1309	2	235.14842	11.85158	7.38157	0	0	0	0	0	0
1340.93738	132.8096	95.05264	0.72792	0.13089	2	234.78002	12.21998	7.74997	0.0033763	0.003376344	0.0011267	3.806E-06	0.2717433	0.50306
1340.5728	133.31267	94.95413	0.39156	0.131	2	234.53670	12.46330	7.99329	0.0065659	0.006565865	0.0021934	1.441E-05	0.5291832	1.00613
1340.47888	133.81574	94.8443	0.48959	0.13103	2	234.26542	12.73458	8.26457	0.0101219	0.0101219	0.0033854	3.431E-05	0.8170506	1.5092
1340.36539	134.3188	94.73633	0.47629	0.13107	2	233.99874	13.00126	8.53126	0.0136177	0.013617712	0.00456	6.219E-05	1.1009153	2.01226
1340.28916	134.82187	94.62698	0.49239	0.13109	2	233.72864	13.27136	8.80135	0.0171582	0.017158206	0.0057524	9.889E-05	1.3892949	2.51533
1340.23712	135.32494	94.51597	0.49963	0.13111	2	233.45445	13.54555	9.07555	0.0207524	0.020752447	0.0069659	0.0001449	1.6829703	3.0184
1340.18333	135.828	94.40481	0.51136	0.13112	2	233.17988	13.82012	9.35011	0.0243515	0.024351544	0.008184	0.0001998	1.9779747	3.52146
1340.14424	136.33107	94.29281	0.52018	0.13114	2	232.90324	14.09676	9.62675	0.0279778	0.027977838	0.0094143	0.0002642	2.2761573	4.02453
1340.09865	136.83414	94.18071	0.52813	0.13115	2	232.62635	14.37365	9.90364	0.0316074	0.031607371	0.0106488	0.0003378	2.5755656	4.5276
1340.08689	137.3372	94.06531	0.53595	0.13115	2	232.34132	14.65868	10.18868	0.0353437	0.035343749	0.0119228	0.0004231	2.8847967	5.03066
1340.07517	137.84027	93.9516	0.54423	0.13116	2	232.06045	14.93955	10.46954	0.0390254	0.039025409	0.0131815	0.0005167	3.1905063	5.53373
1340.0454	138.34334	93.83718	0.55253	0.13117	2	231.77783	15.22217	10.75216	0.0427301	0.042730058	0.0144512	0.0006205	3.4991399	6.0368
1340.04575	138.8464	93.72285	0.56145	0.13117	2	231.49544	15.50456	11.03455	0.0464318	0.046431792	0.0157232	0.0007339	3.8085542	6.53986
1340.03101	139.34947	93.60591	0.57043	0.13117	2	231.20660	15.79340	11.32339	0.050218	0.050218032	0.0170276	0.0008599	4.126097	7.04293
1340.01912	139.85254	93.49016	0.58031	0.13117	2	230.92070	16.07930	11.60930	0.0539657	0.053965742	0.0183222	0.0009948	4.4414757	7.546
1340.01128	140.3556	93.37338	0.59086	0.13118	2	230.63225	16.36775	11.89774	0.0577468	0.057746802	0.0196318	0.0011411	4.7607436	8.04906
1340.00459	140.85867	93.25581	0.60214	0.13118	2	230.34185	16.65815	12.18814	0.0615534	0.06155344	0.0209538	0.0012988	5.083277	8.55213
1340.0113	141.36174	93.13632	0.61277	0.13118	2	230.04671	16.95329	12.48328	0.0654222	0.065422243	0.0223011	0.0014698	5.4122217	9.0552
1340.0029	141.8648	93.01376	0.62579	0.13118	2	229.74399	17.25601	12.78600	0.0693904	0.069390445	0.0236868	0.0016566	5.750824	9.55826
1340.00971	142.36787	92.88773	0.63935	0.13118	2	229.43269	17.56731	13.09730	0.073471	0.073470998	0.0251159	0.0018607	6.1002956	10.06133
1340.001	142.87094	92.76119	0.65222	0.13118	2	229.12014	17.87986	13.40985	0.0775681	0.077568063	0.0265549	0.002078	6.4524987	10.5644
1339.99817	143.374	92.62986	0.66279	0.13118	2	228.79575	18.20425	13.73424	0.0818202	0.081820217	0.028053	0.0023168	6.8194399	11.06746
1339.99547	143.87707	92.49807	0.67356	0.13118	2	228.47023	18.52977	14.05976	0.0860873	0.086087265	0.029561	0.0025699	7.1891164	11.57053
1340.00083	144.38014	92.36479	0.68429	0.13118	2	228.14103	18.85897	14.38896	0.0904026	0.090402555	0.0310908	0.0028398	7.5644609	12.0736
1339.99727	144.8832	92.2293	0.695	0.13118	2	227.80637	19.19363	14.72362	0.0947894	0.0947894	0.0326509	0.0031286	7.947575	12.57666
1339.99494	145.38627	92.09209	0.70788	0.13118	2	227.46746	19.53254	15.06253	0.0992319	0.099231934	0.034236	0.0034361	8.3371532	13.07973
1339.99629	145.88934	91.95259	0.7204	0.13118	2	227.12290	19.87710	15.40709	0.1037486	0.103748614	0.0358529	0.0037641	8.7348976	13.5828
1340.00774	146.3924	91.8069	0.73111	0.13118	2	226.76304	20.23696	15.76695	0.1084657	0.10846571	0.0375474	0.0041236	9.1520968	14.08586
1340.00496	146.89547	91.66091	0.74265	0.13118	2	226.40245	20.59755	16.12754	0.1131925	0.113192521	0.0392514	0.0045011	9.5720212	14.58893
1339.99716	147.39854	91.51152	0.75318	0.13118	2	226.03345	20.96655	16.49654	0.1180294	0.118029415	0.0410013	0.0049055	10.003676	15.092

1340.00591	147.9016	91.36111	0.76477	0.13118	2	225.66194	21.33806	16.86805	0.1228993	0.1228993 34	0.0427696	0.0053312	10.440288	15.59506
1339.99596	148.40467	91.20851	0.77676	0.13118	2	225.28502	21.71498	17.24497	0.1278402	0.1278401 6	0.0445704	0.0057825	10.885337	16.09813
1339.9946	148.90774	91.05696	0.78824	0.13118	2	224.91069	22.08931	17.61930	0.132747	0.1327469 9	0.0463655	0.0062499	11.329416	16.6012
1339.99166	149.4108	90.89997	0.79901	0.13118	2	224.52293	22.47707	18.00707	0.13783	0.1378299 54	0.0482323	0.0067546	11.791654	17.10426
1339.99185	149.91387	90.7405	0.80983	0.13118	2	224.12904	22.87097	18.40096	0.1429932	0.1429932 14	0.050136	0.0072888	12.263527	17.60733
1339.99557	150.41694	90.5774	0.82077	0.13118	2	223.72618	23.27382	18.80381	0.148274	0.1482740 06	0.052091	0.0078577	12.748597	18.1104
1340.00757	150.92	90.41234	0.83218	0.13118	2	223.31848	23.68152	19.21151	0.1536183	0.1536182 57	0.0540778	0.0084569	13.242048	18.61346
1340.00894	151.42307	90.2466	0.84401	0.13118	2	222.90910	24.09090	19.62089	0.1589845	0.1589845 25	0.0560811	0.0090825	13.740143	19.11653
1340.00758	151.92614	90.0795	0.85468	0.13118	2	222.49637	24.50364	20.03363	0.1643948	0.1643948 27	0.0581096	0.0097377	14.245	19.6196
1340.00518	152.4292	89.9108	0.86653	0.13118	2	222.07968	24.92032	20.45032	0.1698569	0.1698569 33	0.0601664	0.0104244	14.757443	20.12266
1340.00003	152.93227	89.73901	0.87723	0.13118	2	221.65535	25.34465	20.87464	0.1754191	0.1754190 86	0.0622701	0.0111498	15.282145	20.62573
1340.00137	153.43534	89.56573	0.88617	0.13118	2	221.22735	25.77265	21.30264	0.1810295	0.1810294 82	0.0644017	0.0119085	15.814365	21.1288
1339.99435	153.9384	89.39183	0.89623	0.13118	2	220.79782	26.20218	21.73217	0.18666	0.1866599 51	0.0665507	0.0126975	16.351518	21.63186
1339.99095	154.44147	89.21487	0.90668	0.13118	2	220.36073	26.63927	22.16926	0.1923895	0.1923894 97	0.0687478	0.0135289	16.901273	22.13493
1339.99622	154.94454	89.03834	0.91565	0.13118	2	219.92470	27.07530	22.60529	0.1981051	0.1981051 19	0.0709499	0.0143873	17.452893	22.638
1339.99562	155.4476	88.85917	0.92767	0.13118	2	219.48215	27.51785	23.04784	0.2039062	0.2039062 19	0.0731956	0.0152885	18.01607	23.14106
1339.99439	155.95067	88.67834	0.93586	0.13118	2	219.03550	27.96450	23.49449	0.2097611	0.2097610 66	0.0754733	0.0162288	18.587881	23.64413
1339.99946	156.45374	88.49774	0.94614	0.13118	2	218.58942	28.41058	23.94057	0.2156085	0.2156084 66	0.0777593	0.0171992	19.162432	24.1472
1339.98714	156.9568	88.31448	0.95575	0.13118	2	218.13677	28.86323	24.39323	0.221542	0.2215419 9	0.0800906	0.018216	19.749028	24.65026
1339.99818	157.45987	88.13367	0.96214	0.13118	2	217.69016	29.30984	24.83983	0.2273962	0.2273961 89	0.0824024	0.0192514	20.331363	25.15333
1339.99633	157.96294	87.94939	0.97215	0.13118	2	217.23499	29.76501	25.29500	0.2333627	0.2333627 39	0.0847706	0.0203398	20.928579	25.6564
1339.99067	158.466	87.76474	0.98066	0.13118	2	216.77891	30.22109	25.75108	0.2393413	0.2393412 68	0.0871559	0.0214643	21.53079	26.15946
1339.99984	158.96907	87.58269	0.98767	0.13118	2	216.32924	30.67076	26.20075	0.2452356	0.2452356 15	0.0895199	0.0226066	22.12829	26.66253

APPENDIX 24: Data for the reactivity of Vietnamese anthracite at 1390^{o}C.

Temp./- C	Time/ min	Mass/ %	DTA/(mW /mg)	Sensit./(mV/mW)	Segm ent	mg change	mg evolved	CO evolved	%R	%R(adj)	If(X)	Pf(X)	ti(model)	ti(exp)
1391.05548	137.24423	93.56483	0.68599	0.11572	2	231.19869	15.90131	11.83757	0	0	0	0	0	0
1390.70491	137.75825	93.25697	0.84691	0.11582	2	230.43797	16.66203	12.59829	0.0273612	0.004525887	0.0015109	6.842E-06	0.2840369	0.51402
1390.45149	138.27227	92.93922	1.02579	0.1159	2	229.65281	17.44719	13.38345	0.0376431	0.007303442	0.0024404	1.784E-05	0.4589139	1.02804
1390.34564	138.7863	92.61367	1.05297	0.11593	2	228.84838	18.25162	14.18789	0.0481773	0.010574594	0.0035374	3.745E-05	0.6654195	1.54207
1390.27057	139.30032	92.27942	1.0951	0.11595	2	228.02245	19.07755	15.01382	0.058993	0.014328517	0.0047992	6.887E-05	0.9031411	2.05609
1390.1895	139.81434	91.93952	1.13319	0.11597	2	227.18255	19.91745	15.85371	0.0699916	0.018516932	0.0062108	0.0001152	1.1693151	2.57011
1390.15163	140.32837	91.58938	1.16847	0.11599	2	226.31736	20.78264	16.71891	0.0813215	0.023190405	0.0077907	0.0001811	1.46749	3.08414
1390.1107	140.84239	91.23745	1.19974	0.116	2	225.44774	21.65226	17.58853	0.0927094	0.028228347	0.0094994	0.000269	1.7903177	3.59816
1390.07966	141.35641	90.88105	1.23035	0.11601	2	224.56707	22.53293	18.46919	0.1042419	0.033656052	0.011347	0.0003833	2.1397587	4.11218
1390.05112	141.87044	90.51553	1.25869	0.11602	2	223.66387	23.43613	19.37239	0.1160694	0.039543657	0.0133589	0.0005306	2.5207465	4.62621
1390.03047	142.38446	90.14499	1.28583	0.11602	2	222.74827	24.35173	20.28800	0.1280595	0.045826588	0.015515	0.0007147	2.929562	5.14023
1390.01796	142.89848	89.77142	1.3134	0.11603	2	221.82518	25.27482	21.21109	0.1401475	0.052466029	0.0178038	0.0009396	3.364121	5.65425
1390.01206	143.41251	89.39126	1.33731	0.11603	2	220.88580	26.21420	22.15046	0.1524488	0.059523193	0.0202483	0.0012134	3.8289213	6.16828
1390.00689	143.92653	89.00963	1.36238	0.11603	2	219.94280	27.15720	23.09347	0.1647977	0.066900109	0.0228167	0.001538	4.3180146	6.6823
1390.0203	144.44055	88.62694	1.38263	0.11602	2	218.99717	28.10283	24.03910	0.1771809	0.074580514	0.0255052	0.0019184	4.8307855	7.19632
1390.00723	144.95457	88.23936	1.39939	0.11603	2	218.03946	29.06054	24.99681	0.1897223	0.082637586	0.0283415	0.0023642	5.3726546	7.71034
1389.99304	145.4686	87.85487	1.41346	0.11603	2	217.08938	30.01062	25.94688	0.2021637	0.090898118	0.0312668	0.0028717	5.9324651	8.22437
1390.00097	145.98262	87.46795	1.42187	0.11603	2	216.13330	30.96670	26.90296	0.2146838	0.09947155	0.0343217	0.0034531	6.518106	8.73839
1390.00371	146.49664	87.0832	1.42883	0.11603	2	215.18259	31.91741	27.85368	0.2271336	0.108248568	0.0374693	0.0041066	7.1226078	9.25241
1390.0003	147.01067	86.70298	1.43186	0.11603	2	214.24306	32.85694	28.79320	0.2394369	0.117161945	0.040687	0.0048316	7.7417111	9.76644
1390.00006	147.52469	86.31814	1.4313	0.11603	2	213.29212	33.80788	29.74414	0.2518896	0.126419898	0.0440521	0.0056508	8.3903965	10.28046
1389.99808	148.03871	85.943	1.42996	0.11603	2	212.36515	34.73485	30.67111	0.2640285	0.135667625	0.0474373	0.0065374	9.0442073	10.79448
1390.00136	148.55274	85.57031	1.42687	0.11603	2	211.44424	35.65576	31.59203	0.2760881	0.14506797	0.0509032	0.0075096	9.7148949	11.30851
1390.00749	149.06676	85.19982	1.42273	0.11603	2	210.52876	36.57124	32.50751	0.2880765	0.154618611	0.0544506	0.0085717	10.4027	11.82253
1389.99571	149.58078	84.83531	1.41759	0.11603	2	209.62805	37.47195	33.40822	0.2998714	0.164211134	0.0580406	0.0097151	11.100127	12.33655
1390.00047	150.09481	84.47306	1.41155	0.11603	2	208.73293	38.36707	34.30334	0.3115932	0.173932979	0.0617071	0.0109534	11.813832	12.85058
1390.00328	150.60883	84.1144	1.40373	0.11603	2	207.84668	39.25332	35.18959	0.3231988	0.183740379	0.0654352	0.0122849	12.540965	13.3646
1389.99839	151.12285	83.76106	1.39479	0.11603	2	206.97358	40.12642	36.06269	0.3346323	0.193576091	0.0692041	0.0137048	13.277544	13.87862
1389.99796	151.63688	83.41492	1.38523	0.11603	2	206.11827	40.98173	36.91800	0.3458327	0.203375752	0.0729898	0.0152048	14.018882	14.39265
1390.00211	152.15109	83.0708	1.37663	0.11603	2	205.26795	41.83205	37.76832	0.3569679	0.213276836	0.0768464	0.0168085	14.775604	14.90667
1389.99862	152.66492	82.73575	1.36704	0.11603	2	204.44004	42.65996	38.59623	0.3678095	0.223066531	0.0806915	0.0184826	15.531584	15.42069

1389.99125	153.17895	82.40381	1.35582	0.11603	2	203.61981	43.48019	39.41645	0.3785505	0.232908711	0.0845899	0.0202558	16.299565	15.93472
1390.01132	153.69297	82.078	1.34677	0.11603	2	202.81474	44.28526	40.22153	0.3890931	0.242705913	0.0885038	0.0221123	17.072113	16.44874
1390.01319	154.20699	81.76032	1.33831	0.11603	2	202.02975	45.07025	41.00652	0.3993727	0.252387344	0.0924047	0.0240379	17.84361	16.96276
1390.0065	154.72102	81.44916	1.32884	0.11603	2	201.26087	45.83913	41.77539	0.4094413	0.261991662	0.096308	0.0260392	18.617062	17.47679
1389.98815	155.23504	81.14379	1.32042	0.11603	2	200.50631	46.59369	42.52996	0.4193225	0.271532807	0.1002193	0.0281185	19.39358	17.99081
1390.00033	155.74906	80.84316	1.3096	0.11603	2	199.76345	47.33655	43.27282	0.4290504	0.28103633	0.1041493	0.0302818	20.175285	18.50483
1390.00127	156.26309	80.55471	1.30354	0.11603	2	199.05069	48.04931	43.98558	0.4383841	0.290256694	0.1079954	0.0324699	20.941731	19.01886
1390.00115	156.77711	80.2655	1.29742	0.11603	2	198.33605	48.76395	44.70022	0.4477425	0.299600428	0.1119271	0.0347786	21.726673	19.53288
1389.99024	157.29113	79.984	1.28856	0.11603	2	197.64046	49.45954	45.39580	0.4568513	0.308789351	0.1158279	0.0371404	22.50687	20.0469
1390.00009	157.80516	79.71136	1.28204	0.11603	2	196.96677	50.13323	46.06950	0.4656735	0.317776837	0.1196768	0.0395395	23.278057	20.56093
1390.00366	158.31918	79.44575	1.27642	0.11603	2	196.31045	50.78955	46.72582	0.4742681	0.32661485	0.1234948	0.041986	24.044388	21.07495
1389.99951	158.8332	79.18379	1.26985	0.11603	2	195.66315	51.43685	47.37312	0.4827447	0.335410212	0.1273276	0.0445084	24.815032	21.58897
1389.9908	159.34723	78.92572	1.26339	0.11603	2	195.02545	52.07455	48.01081	0.4910954	0.344150813	0.1311703	0.0471032	25.588962	22.103
1390.00011	159.86125	78.67664	1.25682	0.11603	2	194.40998	52.69002	48.62629	0.4991552	0.352657716	0.1349431	0.0497144	26.350103	22.61702
1390.00481	160.37527	78.43275	1.25232	0.11603	2	193.80733	53.29267	49.22894	0.507047	0.361054187	0.1386995	0.0523762	27.109169	23.13104
1390.00324	160.8893	78.19377	1.24681	0.11603	2	193.21681	53.88319	49.81946	0.51478	0.369345256	0.1424412	0.0550884	27.866476	23.64507
1390.00205	161.40332	77.95899	1.24322	0.11603	2	192.63666	54.46334	50.39960	0.5223771	0.377551486	0.1461771	0.0578563	28.623798	24.15909
1390.00139	161.91734	77.7287	1.23902	0.11603	2	192.06762	55.03238	50.96865	0.5298289	0.385658965	0.1499003	0.0606738	29.37975	24.67311
1389.99687	162.43137	77.50285	1.23599	0.11603	2	191.50954	55.59046	51.52673	0.537137	0.393665706	0.1536096	0.0635386	30.134023	25.18714
1389.99975	162.94539	77.28603	1.23329	0.11603	2	190.97378	56.12622	52.06249	0.5441529	0.401403745	0.1572256	0.0663865	30.870421	25.70116
1389.99129	163.45941	77.0693	1.22831	0.11603	2	190.43824	56.66176	52.59803	0.5511659	0.409188587	0.160895	0.0693314	31.618804	26.21518
1390.01196	163.97344	76.85514	1.22529	0.11603	2	189.90905	57.19095	53.12722	0.5580957	0.416929924	0.1645761	0.0723407	32.370654	26.72921
1389.99647	164.48746	76.64686	1.22427	0.11603	2	189.39439	57.70561	53.64188	0.5648353	0.42450496	0.1682097	0.0753647	33.113892	27.24323
1390.00079	165.00148	76.44229	1.22177	0.11603	2	188.88890	58.21110	54.14737	0.5714548	0.431989192	0.1718312	0.0784309	33.8557	27.75725
1389.99708	165.51551	76.24426	1.21999	0.11603	2	188.39957	58.70043	54.63670	0.5778628	0.439275571	0.1753877	0.0814924	34.58519	28.27128
1389.98988	166.02953	76.04618	1.21803	0.11603	2	187.91011	59.18989	55.12616	0.5842723	0.446604316	0.178996	0.0846488	35.326331	28.7853
1389.99657	166.54355	75.85114	1.21537	0.11603	2	187.42817	59.67183	55.60810	0.5905834	0.453859973	0.1825999	0.0878514	36.067556	29.29932
1389.99709	167.05758	75.65918	1.21376	0.11603	2	186.95383	60.14617	56.08243	0.5967949	0.461039008	0.1861973	0.0910976	36.80843	29.81335