Creep Data Manipulation

The format used for the determination of creep curves obtained in this study are outlined in Annexure A and B for a given temperature and stress. Minimum creep rate is obtained from resultant creep curve. The individual columns highlighted in Annexure B and are explained below.

X	Y	X(mm)	Y(mm)	Extension	Time(s)	Gama

"X & Y" Columns:

The data is transferred directly from the obtained digital readings onto the spread sheet, each value being mentally multiplied by 100 prior to tying into the keyboard, thereby speeding up this process. Occasionally a discontinuity occurs in the data where the plotting paper had to be re-adjusted because the entire graph did not fit onto the scanner. In these cases, the scanner would be set to zero at the discontinuity thereby making the adaptation of the data easy.

"X mm & Y mm" columns

The "X" & "Y" columns are converted to mm by multiplying each column by a factor of 25.4 i.e. from inches to millimetres. In the same column each entry is also divided 100 to rectify the above mentioned simplification

"Extension" Column

This column relates the "X mm" column to the true extension of the specimen. As mentioned, a 1.07 mm true extension is reproduced as 15mm line in the X direction on the graph, thus the value of X mm is divided by 14.2 to get the actual extension.

“Time “Column

This column relates the “Y mm” column to time, as this is directly of the time axis. The plotter is set at 10mm/hour fed rate, therefore the values in the Y mm column have to be divided by 10 and then multiplied by 3600 to get a time in seconds. The “TIME” column then shows the duration of the test and therefore the last entry in this column indicates the rupture life.

“Gamma” column

Gamma is the strain-rate of the individual test, and is thus related to the extension of the specimen and hence the “EXTEN” column. To obtain gamma the value in the extension column must be inserted into the following formula:

Gamma = $\sqrt{3}\ln(1+e)$

Which is derived from equivalent shear strain, Gamma = $\sqrt{3^{*}\varepsilon}$

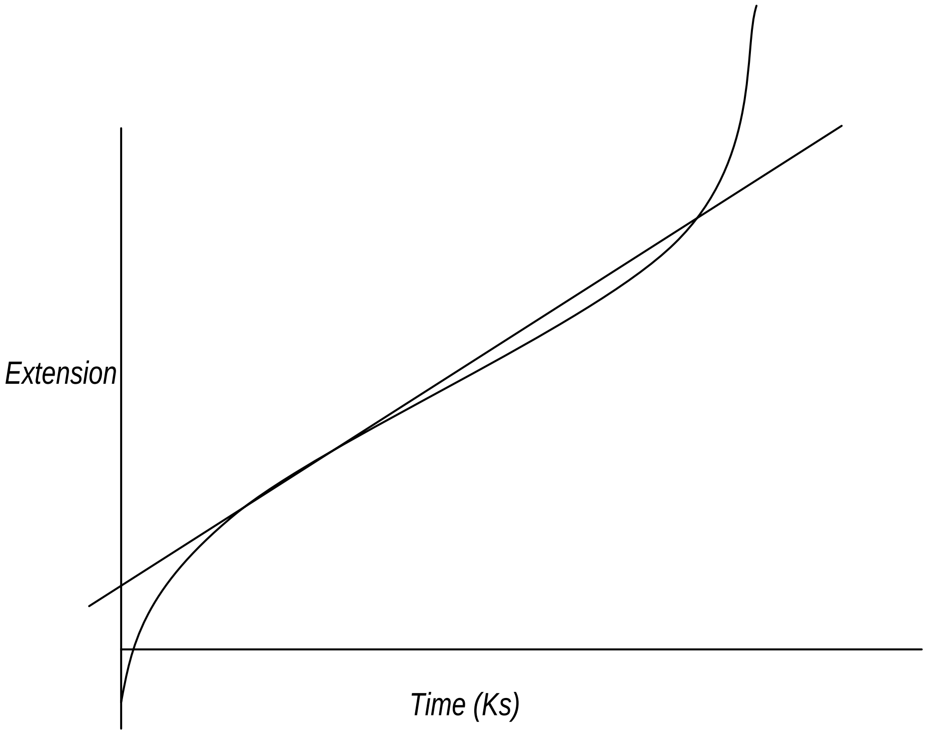
And true strain, $\varepsilon = \ln(1+e)$

Where *e* is the extension (EXTEN) divided by the original specimen length of 50mm.

Once the above columns have been completed, the *“X* “ and “*A”* ranges are specified as “time” and “gamma” respectively and can be plotted.

Determination of the minimum strain rate

The minimum strain rate is obtained by visually isolating the range on the graph which has the shallowest gradient and then returning to the actual range of values which make up the graph and then drawing a straight line along this gradient. By calculating the gradient of this straight line the minimum strain rate is obtained



Sample calculation of the true stress

Force on the pan = Mg = 9.81M

Cross section area of the specimen = πr^2 = $\pi(0.0025)^2$

Force on the pan =9.81M x11 =107.91M

Tensile Stress= $\frac{107.91M}{\pi(0.0025)^2}$ = $\frac{107.91M}{\pi(0.0025)^2}$

Shear stress = $\frac{107.91M}{\pi(0.0025)^2}\frac{1}{\sqrt{3}}$ = $\frac{107.91M}{\pi(0.0025)^2}\frac{1}{\sqrt{3}}$

At temperature > 573K but < 923K

$$U_T = U_o\left[1+\frac{T-300T_m du}{T_m udT}\right]-K_i(T-573)$$

Where $U_o = 8.1x10^{-4}Mpa$, T_m =876K, $\frac{T_m du}{udT} = -1.09$, K_i = 3.2 x 10^{-2} MPa/K