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Darko, Germaine

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The Oxidation And Precipitation Of Iron From A Manganese Sulphate Solution

Germaine Darko

A Dissertation Submitted to the Faculty of Engineering, University of the Witwatersrand, Johannesburg in fulfilment of the requirements for the Degree of Master of Science in Engineering.

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Declaration

I, the undersigned, Germaine Darko, do hereby declare that the contents of this dissertation are solely my work except where specific acknowledgement is made. This dissertation has not been submitted for a degree at any other university or institution.

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Germaine Darko

ABSTRACT

In many metallurgical processes such as the production of zinc, copper, manganese, nickel and cobalt, the mineral ore usually has metallic impurities, of which iron is the most common. Separating the iron from the mineral of interest is a common problem in these processes. In this dissertation, the oxidation of ferrous sulphate in the presence of manganese was studied in a stirred batch reactor operating at atmospheric pressure. Molecular oxygen and air were used as oxidants.

Systematic kinetic experiments were carried out at initial ferrous concentration and temperature ranges of 5 – 20 g/l and 55 – 85 ^{o}C respectively. The results revealed that iron could be selectively precipitated out from manganese sulphate solution. Analysis of the solids showed that iron is separated out in form of goethite precipitate ($Fe_2O_3.H_2O$). Although this compound seemed to be the most dominant species in the solids, small amounts of sulphate and manganese contaminants were also evident.

The experimental data were fitted to a rate equation and found to be fractional order with respect to the ferrous concentration and first order with respect to the oxygen partial pressure. The rate equation was similar to that proposed by Rönnholm *et al* (1999) based on a non-catalytic mechanism of the oxidation of ferrous sulphate. The model fitted the experimental data reasonably well.

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