

# National Institute for Metallurgy Nasionale Instituut vir Metallurgie

## VERSLAG — REPORT

No. 1365

### STUDIES OF INCIPIENT FUSION IN THE SYSTEM CHROMITE—MgO—Al<sub>2</sub>O<sub>3</sub>—SiO<sub>2</sub>—C

5th January, 1972

Investigator: N. A. Barcza

#### SYNOPSIS

A fundamental study was made of twelve chromite ores by use of a thermobalance under atmospheric and reducing conditions. It was found that their thermal behaviour under atmospheric conditions can be related to the mineralogical composition of the chromite spinel and the gangue. The overall mechanism of reduction with solid carbon over the temperature range of 1 200 to 1 500 °C was shown to be diffusion of carbon through the reaction product.

The effects of additions of fluxes and variations in particle size on the kinetics and mechanism of reduction were determined. It was shown that carbon monoxide does not reduce chromite ore up to temperatures of 1 550 °C, and it can therefore be eliminated as the diffusing reducing species. However, the reaction product of reduction, namely a mixed carbide of iron and chromium, was shown to be an effective reducing agent for chromite ore, while also facilitating the transport of carbon.

## VERSLAG — REPORT

No. 1380

### AN ELECTROCHEMICAL MODEL FOR THE LEACHING OF URANIUM DIOXIDE

10th January, 1972

Investigators: C. R. S. Needes, M. J. Nicol

#### SYNOPSIS

A correlation between the rate of leaching of UO<sub>2</sub> and the electrochemical properties of the oxidant concerned has been derived. This correlation is found to be borne out by experimental results. Certain effects observed in UO<sub>2</sub> leaching and hitherto unexplained have been clarified in terms of an electrochemical mechanism. Experiments have shown that the mixed potential of a UO<sub>2</sub> electrode gives a measure of the rate of dissolution of UO<sub>2</sub>. Its significance to commercial practice is discussed.

#### CONCLUSIONS

- (1) The dissolution of UO<sub>2</sub> in the presence of a number of oxidants can be explained in terms of an electrochemical mechanism.
- (2) The mixed potential of the UO<sub>2</sub> electrode is a measure of the rate of UO<sub>2</sub> leaching. This principle could be used in the control of industrial leaching operations.
- (3) A simple treatment has provided a mathematical basis for a fundamental correlation between the rate of UO<sub>2</sub> dissolution and the chemical properties of the oxidants concerned. This relation has been found to agree well with experimental results.
- (4) A number of phenomena occurring during the leaching of UO<sub>2</sub>, hitherto not explained in a satisfactory manner, have now been clarified in terms of an electrochemical mechanism.

## Book Note

### **Thermochemistry of Rare Earth Carbides, Nitrides and Sulphides for Steelmaking,**

by *K. A. Gschneider Jr.*  
and *N. Kippenham.*

This is a bound 28 page study of the free energies of the carbides, nitrides and sulphides of the rare earths at

steelmaking temperatures. The research and reporting have been done under grant from Molybdenum Corporation of America.

Copies are available to metallurgists, development personnel, and engineering libraries free of charge on application to:

Molybdenum Corporation of America,  
280 Park Avenue,  
New York N.Y. 10017.