

WEDNESDAY, AUGUST 24, 2005, P.M.

SESSION 45: INTERNATIONAL CONFERENCE ON NICKEL AND COBALT

PROCESS FUNDAMENTALS II

Sponsor(s): The Non-Ferrous Pyrometallurgy Section, Metallurgical Society of CIM

Room: Doll

Chair(s): T. UTIGARD, University of Toronto, Canada and

B. DAVIS, Kingston Process Metallurgy, Canada

PAPER 45.1—14:00

REDUCTION KINETICS OF GORO NICKEL OXIDE USING HYDROGEN.

T. UTIGARD, M. WU, G. PLASCENCIA, University of Toronto, Canada

A. VAHED and J. LIU, Inco Technical Services Ltd., Canada

Nickel oxide granules formed by pyrohydrolysis of a chloride solution, were reduced in hydrogen. Below 400°C, an incubation period was observed, followed by very slow reduction. In the temperature range from 400 to 600°C, the rate of reduction increased with increasing temperature and increasing hydrogen pressure. Microscopic analysis showed that in this temperature range the reaction followed the shrinking core model. Above 600°C, the reduction rate decreased noticeably before suddenly becoming very fast at and above 950°C. Microscopy showed inner bands of metallization inside the outer metallic rim, indicating partial blockage of the interface between the reacted and unreacted NiO core. At these temperatures, particle agglomeration and sintering were also found to take place. Surface segregation of sulphur may account for the slow down in reduction rate above 600°C. From an industrial point of view, reduction should be carried out from 550 to 600°C with as high a concentration of hydrogen as possible. If sintering and agglomeration are not of any concerns, reduction can be carried extremely fast at about 1000°C.

PAPER 45.2—14:25

MICROWAVE ENHANCED DRYING OF NICKELIFEROUS LIMONITIC LATERITE ORES.

J. BRADLEY and C. PICKLES, Queen's University, Canada

Nickeliferous limonitic laterite ores contain considerable free moisture. In this research the application of microwave radiation for the drying of this ore was investigated. The effects of sample mass, initial moisture content and porosity on the microwave drying rate were studied and the results were compared to those obtained with conventional drying. Further, enhancement of the microwave drying rate was achieved by increasing the flow rate of air over the sample and by operating at reduced pressure. The high microwave drying rates were attributed to the inverted temperature gradient which results in internal boiling and this promotes both liquid and vapour movement to the surface.

PAPER 45.3—14:50

EXTRACTION OF COBALT DIRECTLY FROM PAL SOLUTIONS USING ELECTROSTATIC PSEUDO LIQUID MEMBRANE (ESPLIM).

D. IBANA and J. COLLARD, Western Australia School of Mines, Australia

This study investigated the extraction of cobalt from pressure acid leach solutions of nickel laterite ores by the direct solvent extraction route using ESPLIM. It explored the various variables that affect the dispersion of the aqueous phase in the organic phase such as ionic strength, viscosities of the phases, initial droplet size, etc. so that phase hold-up and thus extraction could be effectively controlled. In addition, the use of gaseous ammonia as pH modifier was explored. The results show that the technique allows a much better control of phase dispersion circumventing one of the main weaknesses of conventional solvent extraction.

COFFEE BREAK—15:15-15:45

PAPER 45.4—15:45

EFFECT OF MECHNOCHEMICAL TREATMENT ON THE EXTRACTION RATIO OF Ni FROM Ni ORE.

T. NAKAMURA, Tohoku University, Japan

H. ITOU and T. TAKASU, Kyushu Institute of Technology, Japan

Effects of a mechanochemical treatment to oxide Ni ores have been investigated to enhance the extractive ratio of Ni from them in acid leaching process. High intensity grinding by a planetary ball mill showed strong effect to enhance the extractive ratio of Ni, for example, 10% of extractive ratio of Ni in sulfuric acid leaching (0.05 mol/l, at room temperature) increased to more than 90% with 60 min. of planetary ball milling (700 rpm). And effects of additives (S and some oxidants) on the mechanochemical treatment have also studied. S showed almost no effect to enhance the total Ni extractive ratio but increases the selectivity of Ni extraction. More than a half of Ni could be extracted by water

when Ni ore was grinded at addition of $\text{Na}_2\text{S}_2\text{O}_7$ in the milling treatment. Various effects of mechanochemical treatments to Ni ore are summarized in this paper.