WEDNESDAY, AUGUST 25, 2004, P.M.

SESSION 56: FIFTH INTERNATIONAL SYMPOSIUM ON WASTE PROCESSING AND RECYCLING IN MINERAL AND METALLURGICAL INDUSTRIES

RESOURCE RECOVERY FROM PROCESS WASTES
Sponsors: Hydrometallurgy, Non-Ferrous Pyrometallurgy, Iron and Steel Sections and Environment Committee of the Metallurgical Society of CIM and the Environmental Society of CIM
Room: Chedoke B
Chairmen: L. M. AMARATUNGA, Laurentian University, Sudbury, Ontario, Canada, and P. RIVEROS, CANMET, Ottawa, Ontario, Canada

PAPER 56.1 — 14:00
MINE EFFLUENT TREATMENT FOR RECOVERY OF GOLD IONS USING HIGH CAPACITY NONTECHNOLOGY ADSORBENTS.
A. EL-HSAERI, L.M. AMARATUNGA and L. MERCIER, Laurentian University, Sudbury, Ontario, Canada

Laboratory scale studies of the development and application of high capacity heavy metal ion adsorbents with uniform nanoscale porosity (denoted MP-HMS) to extract gold from solutions is described. The adsorbents are selective towards gold ions. The adsorption capacities of these materials are also among the highest reported. MP-HMS has shown the capability to adsorb 330-mg gold per gram from a solution of gold (up to 30% of their weight). Gold uptake by the adsorbent was found to increase dramatically with solution agitation. The adsorbent was found to be extremely effective in adsorbing gold ions from ultra- low concentrations, like those found in mine effluents. Experimental studies indicated that MP-HMS maximum adsorption of gold (99.9%) occurred under all solution concentrations. Another promising attribute of these materials is their favorable adsorption kinetics. The contact time required for 80% adsorption of gold was found to be less than 60 seconds. The efficiency of these nanoporous materials for the recovery of gold from mining effluent is evaluated and their prospect for application in the mining industry discussed. The process thus has the prospect of becoming an efficient and environmental friendly method to recover gold from aqueous solutions.

PAPER 56.2 — 14:25
RECYCLE OF SILICON FOR SEMICONDUCTORS BY PYRO-METALLURGICAL PROCESS.
N. YAMAUCHI, T. SHIMADA, I.I.S. Materials Company Ltd, Meguro, Japan, and M. MAEDA, University of Tokyo, Tokyo, Japan

The electron beam melting technique was used for the purification of scrap silicon. A large-scale electron beam apparatus that had two guns, a cold hearth, a water-cooled copper crucible and several sensors was developed. The maximum power of each guns was 200kW. The water cooled hearth capacity was 0.02 m3 and its evaporation area was about 0.016 m^2. The crucible capacity was 0.02 m3. All data from sensors were logged to PC online. Type N scrap silicon with 10-30 m-ohm.cm resisitivity was used as feedstock and a 30 kg weight polycrystalline ingot of refined silicon was resulted. This ingot was re-cast as a CZ single crystalline ingot for evaluating its properties, which was cut into several wafers and evaluated for composition and resistivity.

PAPER 56.3 — 14:50
REVERSING THE PHILOSOPHER'S STONE III: RECOVERING IRON AND OTHER METALS FROM SLAGS AND RESIDUES.
L.M. SOUTHWICK, L.M. Southwick & Associates, Cincinnati, Ohio, U.S.A.

Processing of ores to recover metals usually generates large amounts of waste materials, such as rejects from concentrating operations, tailings from leaching and slags from smelting. These wastes often contain substantial amounts of iron and other metals, recovery of which are often considered to be of commercial value. Earlier versions of this paper investigated a number of processes built to recover iron from a variety of copper processing residues. This paper will extend that coverage to residues from nickel/cobalt, aluminum, asbestos and oil shale processing and coal plant fly ash. Products of interest are iron, ferroalloys, magnesium and aluminum. While none of these processes achieved long-term commercial success, their efforts cover the gamut of problems that must be addressed in treating dirty and difficult materials to recover generally low-value products.

COFFEE BREAK — 15:15 – 15:40

PAPER 56.4 — 15:40

EVALUATION OF KIRKA BORON PLANTS TAILINGS.

A.A. SIRKECI, G. BULUT, N. ACARKAN, O. KANGAL and M. TARKAN, Istanbul Technical University, Maslak, Istanbul, Turkey

Ways of evaluating the tailings of the boron plant were investigated. In this respect boron in the tailings were recovered and the utilization of the clayish fraction were investigated. First stage tailings pond where coarse fraction is accumulated contains 28% B_2O_3. In the later stage tailings ponds B_2O_3 content goes up to 16.5% where 87% of the material is finer than 38μm. Effluents of sodium penta-borax plant are saturated in boron therefore those tailings ponds contains secondary borax compounds and B_2O_3 content is around 29.5%. Experiments were conducted with samples taken from ponds containing coarse fraction and fine fraction. Coarse fraction of Borax Concentrator were screened through 1 mm. The fraction above 1 mm was removed with 41.5% recovery and 33.3% B_2O_3 content. Scrubbing was applied above 0.1 mm and products containing 32 to 34% B_2O_3 were obtained with recoveries between 35 and 40%. The tailings of sodium pentha borax was screened through 1 mm. It was found that 15% of boron reported to +1 mm size fraction with 35% B_2O_3 content. As a conclusion it is possible to achieve $180-200 million income by simply screening 10 million tons of boron processing tailings and producing a concentrate containing 33-34% of B_2O_3.

PAPER 56.5 — 16:05

CLEAN COAL PRODUCTION FROM COAL WASHING PLANT WASTES.

G. ÖNAL and F. BOYLU, Istanbul Technical University, Maslak, Istanbul, Turkey

In this study, the fine coal waste subjected to the experiments is taken from the waste stockpile of Soma Coal Plant. The possibilities of its evaluation and the production of clean coal were investigated. For this purpose, Reichert Coal Spiral and Shaking Table are used. The minus 1 mm coal waste includes 60.43% ash and 50% minus 38 micron material by weight.

The microscopic observations of the screen fractions were shown that the clay minerals are in fine sizes and the coarser size fractions contain silica and carbonate minerals as ash forming materials.

The tests were conducted after desliming. The commercial grade clean coal product containing 29-35% ash with a calorific value of 3800-4200 kcal/kg (15.91-17.58 MJ/kg) was obtained by gravity methods.

PAPER 56.6 — 16:30

EVALUATION OF METALLIC VALUES FROM ANCIENT SLAGS.

G. BULUT, A. GÜL, O. KANGAL and G. ÖNAL, Istanbul Technical University, Maslak, Istanbul, Turkey

The recovery of copper and cobalt from the ancient copper slags, located in Küre-Turkey, is investigated. Fayalitic type of ancient copper slags containing 1.41% Cu, 0.53% Co and 53.16% Fe were subject to the experimental study. Magnetic separation, gravity concentration and flotation test were conducted. The results of magnetic separation and gravity concentration were not satisfactory. However, a concentrate containing 9.57% Cu could be produced with 44.7% recovery by flotation. Copper and cobalt that remained in the flotation tailings was recovered by roasting with sulfuric acid followed by hot water leaching. Complete cobalt dissolution was observed in 1 hour of roasting at 150^0C and 3:1 acid/slag ratio, whereas the copper recovery was 83%.