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Book news

1. Mintek reports

The following reports are available from Mintek (Private Bag X3015, Randburg, 2125 South Africa) at a price of R35 (R30,97 + R4,03 GST) to South African addresses, and US$30 per copy (including airmail postage) to addresses elsewhere.

• Report M383

A new low-alloy steel for rails in the gold-mining industry, by R.T. White and R. Paton. Dec. 1989. 21 pp.

There is an increasing need for the mining industry to reduce operating costs via increased efficiency. One way of achieving this is through the use of materials that have longer lives. A review of rail steels used worldwide showed that most of the information available on the performance of the steels applied to conditions above ground. Very little information has been published on the performance of rail steels underground. A survey carried out by the authors on South African gold mines showed that corrosion is a major problem, especially where the mine waters are acidic.

None of the present standard carbon- and low-alloy grades of steel were considered to be sufficiently corrosion resistant in acidic mine waters. Therefore, laboratory trials were carried out in an effort to improve the corrosion resistance of a standard grade of low-alloy steel, viz ENI9A (BS970 grade 708M40). From the literature search, it had been deduced that controlled additions of copper, silicon, and aluminium might prove beneficial in the optimization of corrosion resistance.

An incomplete-cubic simplex design algorithm was used in the construction of iso-corrosion areas in a ternary space of copper, silicon, and aluminium. The Tafel extrapolation method was used in the measurement of the corrosion rates of master alloys. The higher copper–high silicon end of the triangle yielded the best corrosion rates. A value of 0,5 mm per year was obtained in this apex. This is considered to be acceptable, and is approximately an order of magnitude better than the values obtained for samples taken from mine rails currently in use. It is recommended that, for successful commercialization, a field study should be carried out on a tonnage melt of the proposed steel. The possible use of this alloy for general structural application underground should be kept in mind.

• Report M388

The determination of hydride-forming elements and the elimination of interferences by use of a flow-injection hydride generator, by G.D. Marshall. Jan. 1990. 13 pp.

A laboratory method is presented for the determination of elements that form gaseous hydrides. The hydrides are generated in a flow-injection manifold, and are detected with the use of atomic-absorption spectrophotometry. Three variations of the basic manifold are described that permit the elimination of certain interferences.

Interferences that result from more than one stable oxidation state of the analyte are overcome by the in-line addition of potassium iodide. Noble-metal interferences during the determination of antimony, arsenic, bismuth, and selenium are reduced by the in-line addition of tellurium. Base-metal interferents in the determination of arsenic and selenium are removed by means of in-line ion exchange. General matrix-related interferences are overcome by the automation of the process of standard additions.

The conditions used yield sensitive results for antimony, arsenic, bismuth, selenium, and tellurium. The other gaseous hydride-forming elements—germanium, lead, and tin—are determined with a sensitivity similar to that achievable by flame atomization. The precision of measurement as indicated by the relative standard deviation is 0,037. Thirty samples can be analysed per hour, and less than 1 ml of sample is necessary for each analysis.

• Report M394

Impeller life in pumps for heavy-mineral concentrates, by D.P. Enright. Dec. 1989. 18 pp.

This report describes the testing of impellers in a heavy-mineral concentrate pump at De Beers Consolidated Mines, Premier Mine Division, Cullinan.

Wear was monitored according to recorded service life, power drawn, loss of mass, and progressive wear of the vanes.

Impellers made from three different types of high-chromium white iron (HCWI), rubber, and two alumina-based materials, all from local suppliers, were tested.

Effectively, the three HCWI impellers performed equally well. Metallographic examination showed a correlation between their microstructure, hardness, and chemical composition.

Although the service lives of the alumina-based impellers were about 30 per cent longer than those of the HCWI impellers, this was not sufficient to make them cost-effective. Further developmental work is needed to improve the alumina impellers' resistance to damage by tramp material passing through the pump.

The rubber-lined impeller was found to be unsuitable for this application.

No definitive measure could be established to indicate the end-point of an impeller's service in this application.

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