

# Book News

## 1. New Publications

● *Tin and its uses* no. 140. Greenford (England), International Tin Research Institute, 1984.

This issue contains articles on composite electroplated coatings of tin with non-metallic inclusions such as silicon carbide and molybdenum disulphide, available training courses in the theory and practice of soldering and related techniques, the manufacture of decorative laminates for the home, and pewter figurines as manufactured and displayed in Kulmbach (north Bavaria).

● *Catalogue. English translations of German standards 1984*. Berlin, Beuth Verlag GmbH, 1984.

Of about 20 000 DIN standards, the most important have been translated into English, so far about 3500. These cover a wide spectrum of technological fields, ranging from civil and electrical engineering, iron and steel, machine tools, plastics, mechanical engineering, to methods of testing for numerous kinds of materials. Every month about 30 more translations are issued, and the 1984 catalogue represents the current state of affairs. In addition to the alphabetical and numerical index, nearly 200 pages deal with the subject matter of the standards. This subject portion of the catalogue is arranged according to technical fields based on the Universal Decimal Classification (UDC) System.

● *Mining and mineral processing operations in Canada 1983*. Ottawa, Canadian Government Publishing Centre, 1984. \$6.00.

This publication is a compilation of information relating to mines and processing facilities in Canada. This information was obtained primarily, as in previous years, by means of a questionnaire sent to all the companies concerned.

● *Canadian mineral deposits not being mined in 1983*. Ottawa, Canadian Government Publishing Centre, 1984. \$6.00.

This is an inventory of Canadian mineral deposits that are not or will not be in production at the end of 1983. The compilation is based on data at hand in late May 1983. It is intended as a handy reference to potential mineral producers.

## 2. Mintek Publications

The following are available free of charge from the Council for Mineral Technology, Private Bag X3015, Randburg, 2125 South Africa.

### ● Report M42D

*The recovery of tantalite and cassiterite from a bulk sample of pegmatite supplied by Falconbridge Explorations Limited.* (First issued 1982.)

The bulk sample supplied had an average content of 275 p.p.m. of tantalum, 178 p.p.m. of niobium, and 684 p.p.m. of tin. In preliminary tests, no concentration of the valuable

minerals could be effected by selective crushing, jigging, or tabling at sizes larger than 1 mm. Significant concentration of material between 1,5 and 0,8 mm was obtained by heavy-liquid separation, but recoveries of the valuable minerals were not sufficiently high to warrant further work at that stage on the possibility that heavy-medium separation could be used for preconcentration of the ore.

Further preliminary concentration tests were done so that the procedure to be used for a test on a 480 kg batch of ore could be selected. In this test, the ore previously ground to material smaller than 600  $\mu\text{m}$  was treated to yield a coarse classified product, which was enriched in the valuable minerals, and a fine table concentrate. The recoveries of tantalum, niobium, and tin from these two products (the primary concentrates) were 86,8 per cent, 76,1 per cent, and 84,0 per cent respectively. Several stages of retreatment of the primary concentrates of a laboratory shaking table gave a final combined concentrate assaying 13,6 per cent tantalum, 7,2 per cent niobium, and 33,2 per cent tin, with recoveries of 78,2 per cent of the tantalite, 66,7 per cent of the niobium, and 73,7 per cent of the tin in the original sample.

The final gravity concentrate was screened into three size fractions and separated into tantalite and cassiterite concentrates by high-intensity magnetic separation. The following results were obtained for the combined concentrates:

Element	Assay, %		Recovery, % of metal in sample	
	Tantalite conct.	Cassiterite conct.	Tantalite conct.	Cassiterite conct.
Ta	31,0	1,38	74,1	—
Nb	17,0	0,22	65,6	—
Sn	2,6	65,1	—	70,7

In an additional test on the treatment of the gravity concentrate, a tantalite concentrate assaying 36 per cent tantalum and 20 per cent niobium, and a cassiterite concentrate assaying 70 per cent tin, were obtained.

### ● Report M46D

*Tests on the nature and reduction of the chlorine in fluorspar concentrate from the western Transvaal.* (First issued 1982.)

Tests were done on a sample of fluorspar flotation concentrate from Marico Fluorspar Mine. No reduction of practical importance was obtained in the chlorine content of approximately 505 p.p.m. by use of the following procedures:

- (i) removal of the moisture present in the concentrate,
- (ii) attrition scrubbing to remove surface coatings,
- (iii) removal of the magnetic constituents by wet high-intensity magnetic separation, or
- (iv) leaching with hydrofluoric acid to decompose suspected chlorine-bearing silicates.

It is concluded that most of the chlorine is present as

saline liquid in minute inclusions in the fluorspar. This conclusion is supported by the following observations:

- (1) the chlorine content of size fractions of the fluorspar decreases markedly with particle size,
- (2) fluorspar that floats in a liquid of relative density 3,15 is enriched in chlorine (to 910 p.p.m.), and
- (3) leaching with water after fine grinding significantly reduces the chlorine content.

However, the total reduction in the chlorine content that was obtained by leaching after grinding was only 27 per cent from material ground to 80 per cent smaller than 38  $\mu\text{m}$  and 45 per cent from material ground to over 99 per cent smaller than 38  $\mu\text{m}$ .

#### ● Report M58D

*An electrochemical process for the recycling of tungsten carbide scrap.* (First issued 1982.)

An account is given of the development of a number of designs for electrochemical cells, and the subsequent construction and operation of a vibrating-plate cell capable of oxidizing 15 kilograms of tungsten carbide a day to a crude tungstic acid precipitate, with simultaneous recovery of cobalt metal on the cathode.

The effects on the process of the reagent concentration, temperature, current density, and cathode material are discussed.

#### ● Report M59D

*Testwork on samples of oxidized ore from the Potgietersrus Prospect.* (First issued 1982.)

This report describes an investigation into methods for the profitable treatment of oxide overburden at the Potgietersrus Platreef orebody.

A limited degree of physical beneficiation was achieved by reduction roasting followed by magnetic separation. Leaching with warm cyanide appeared to be more promising for the recovery of palladium and of gold, but further tests would be required for an assessment of its efficiency in the recovery of platinum.

#### ● Report M60D

*The production of electrolytic manganese dioxide from furnace sludge.* (First issued 1983.)

The ferromanganese furnaces of the sponsor produce fines that are collected in scrubbers and are then impounded as a waste product (furnace sludge).

The Council for Mineral Technology (Mintek) tested various leaching procedures to solubilize the manganese constituent (about 25 per cent) and to convert the manganese sulphate liquor to battery-grade electrolytic manganese dioxide (EMD) by electrolysis. Continuous runs were conducted on miniplant scale (with a 4-litre electrolytic cell) and on pilot-plant scale (with a 1500-litre electrolytic cell). Several types and shapes of electrode were tested, including carbon, graphite, titanium rods, and titanium sheets.

A number of Japanese and other international standard samples were analysed for comparison with the material produced at Mintek. A comparison was also made between the material produced from prerduced manganese ore and that produced from furnace fines.

The recovery of manganese from the furnace fines was about 75 per cent. However, the leach liquors had to be purified for the removal of soluble organic matter.

The operation of the electrolytic cell was optimized, and internationally acceptable grades of EMD were produced.

Electrolyte: 35 to 40 g of  $\text{H}_2\text{SO}_4$  and 60 g of Mn per litre

Cell temperature: 90 to 93  $^\circ\text{C}$

Current density: 80  $\text{A}\cdot\text{m}^{-2}$

Current efficiencies: 85 to 90 per cent.

Corrugated titanium sheets coated with ruthenium oxide to prevent passivation gave the best quality of EMD (with an available oxygen content, expressed as  $\text{MnO}_2$ , of 92 per cent, which is better than the international specification of 90 per cent  $\text{MnO}_2$  as minimum).

Batches of the material produced at Mintek were submitted to battery manufacturers in the U.K., Japan, Germany, and the U.S.A. for evaluation.

#### ● Report M64D

*Isotope-source neutron-activation analysis for the determination of manganese in bulk samples.* (First issued 1982.)

A method for the rapid determination of manganese in ores, metals, and slags has been developed for use on site in the control of large submerged-arc ferromanganese furnaces. The method, which is suitable for samples that weigh several kilograms, requires a minimal amount of sample preparation. Isotope-source neutron-activation analysis (ISNAA) is used, a specially constructed apparatus being employed for irradiation and counting.

The presence of boron in the ores presents a problem that was overcome by separate measurement of the neutron absorption. The theory that was developed confirms that this method is very suitable for the analysis of bulk samples.

Tests were done on a suite of samples that had been analysed by the use of X-ray-fluorescence spectrometry (XRFS). The root-mean-square (r.m.s.) deviations between the results for manganese by XRFS and ISNAA were found to vary from 0,7 per cent for the slags and 0,8 per cent for the ores to 1 per cent for the silico-manganese metal. This compares well with the r.m.s. deviations between the results for XRFS and wet chemistry, each of which was used by a different laboratory on the same set of samples. With further development, ISNAA should yield even better results, and be suitable in a wide variety of applications.

#### ● Report M128

*The determination of cyanide in hydrometallurgical process solutions and effluents by ion chromatography.*

Three methods are described for the determination of cyanide species in hydrometallurgical process solutions and in effluents.

The determination of excess cyanide in the presence of weak cyanide complexes was achieved by the use of a flow-injection system with 0,05 mM sodium chloride as the carrier stream. The procedure was found to be fast, precise ( $s_r$  0,0142), and reasonably accurate.

Free cyanide and cyanide derived from weak metal

cyanide complexes were determined by ion chromatography. This method is free from interferences and precise ( $s_r$  0,0112), and has a limit of determination of 10  $\mu\text{g/l}$ .

The 'total' cyanide content of solutions was determined by ion chromatography after the strong metal cyanide complexes had been dissociated in hypophosphorous acid by ultraviolet irradiation. The procedure (of 10 minutes duration) is faster than conventional distillation methods, and is accurate and precise ( $s_r$  0,027).

#### ● Report M132

*Mineralogical parameters influencing the acid-bacterial leachability of low-grade nickel ores.*

The potential leachability of a nickel sulphide ore depends on a number of mineralogical and petrophysical criteria that can be evaluated rapidly before any leaching tests are undertaken. The mode of occurrence of nickel, the permeability of the ore, and the quantities of acid-consuming gangue minerals are of primary importance.

The dissolution rates of sulphides can be considerably enhanced by galvanic interaction, a phenomenon that should be largely predictable on the basis of ore-texture studies.

Many of these parameters are controlled by the degree of hypogene or supergene alteration that the ore has experienced. Weak to moderate alteration is expected to enhance the recovery of nickel, while intense alteration may result in the elimination of sulphide and hence render the ore unleachable.

#### ● Report M134

*The NIMROC reference materials: revised values for thorium, yttrium, lanthanum, and the rare-earth elements.*

This report gives all the analytical results submitted by the contributing laboratories before July 1983 for thorium, yttrium, lanthanum, and the rare-earth elements in the six NIMROC reference materials (SARM 1 to 6), which were prepared in 1966 by the former National Institute for Metallurgy, now the Council for Mineral Technology (Mintek).

The statistical evaluation of these results and the assignment of new or revised recommended or provisional values are described.

#### ● Report M140

*The effect of physical and chemical factors on the corrosivity of a synthetic mine water.*

An investigation is reported in which the corrosivity of a synthetic mine water (based on samples of machine water) on mild steel was measured by laboratory techniques involving loss in mass, the extrapolation of Tafel plots, and polarization resistance. The effects on corrosivity of systematic variation in important properties of the water, such as dissolved-oxygen content, pH, flowrate, temperature, and concentration of ammonium ions, are quantified.

The results indicate that the rates of two cathodic reduction processes (reduction of dissolved oxygen and evolution of hydrogen) control the corrosion rate of mild steel. The effects on corrosivity of much of the dissolved solids (such as chloride, sulphate, and nitrate ions) and of the

total hardness of the water is minimal. This invalidates the use of corrosivity indices based on concentrations of dissolved solids.

Details of projected laboratory and field tests on the corrosivity of mine waters are included.

#### ● Report M144

*The development of standard procedures for the evaluation of magnetite for use in heavy-medium separation.*

The suitability of magnetite for use as a heavy medium in coal-washing plants and in combination with ferrosilicon in other mineral separations depends upon several criteria in terms of physical properties. Different methods are used for the measurement of these physical properties in industry, and various values have been assigned to them. Also, there is as yet no consensus on the comparative importance of these physical properties in the assessment of the quality of the magnetite and its suitability for use as a heavy medium.

This investigation was undertaken by the Council for Mineral Technology (Mintek) to establish to what extent the results of the evaluations disagree, to assess the methods of evaluation used, and, if possible, not only to define criteria by which the properties of the magnetite can be evaluated, but to standardize the methods used in the measurement of these properties.

The properties examined were particle-size distribution, relative density, stability in suspension, magnetic content, magnetic susceptibility, viscosity, and magnetism after demagnetization.

It is shown that the greatest variation in the results occurs in the determination of particle-size distribution, mainly because similar procedures are not standardized and the shape of the particles is irregular. This means that no valid comparison can be made of the different methods used. Finally, the particles flocculate owing to their magnetism. A standard method of wet screening, involving a simple mechanical vibrator, fixed quantities and flowrates of water, and demagnetization of the magnetite before screening, is recommended.

Large variations in the results also occur in the determination of the magnetic content, and it is recommended that the Davis tube should be operated under defined parameters of water flowrate, stroke length, amplitude, and current strength.

#### ● Report M145

*A preliminary study of the mineralogy of the nickel occurrence at Mabilikwe Hill, northern Transvaal.*

Disseminated, and locally more massive, millerite-violarite mineralization is hosted by highly recrystallized limestones at Mabilikwe Hill in the northern Transvaal. Supergene alteration has led to the formation of zaraitite, gaspeite, and a previously undescribed nickel carbonate, here referred to as Mineral M. Mineral M occurs as fine intergrowths with quartz and calcite, which precludes a full description of the mineral from the samples that are currently available. However, provisional information is presented.