Book news

1. Book reviews

● *Dislocations and properties of real materials,* edited by M.H. Loretto. London, The Institute of Metals, 1985. 392 pp.

Reviewer: F.R.N. Nabarro

This volume is the report of a conference held in London in December 1984 'to celebrate the 50th anniversary of the concept of dislocation in crystals', a concept that was introduced in the famous papers of G.I. Taylor, M. Polanyi, and E. Orowan. Egan Orowan, the only survivor of these pioneers, had hoped to attend but was prevented from doing so by illness in the family.

The historical part of the meeting is represented in 11 pages by Sir Nevill Mott's introductory talk, with reminiscences of the early work in Cambridge and Bristol, and by Sir Charles Frank's address giving the background to the dislocation theory of crystal growth and the Frank–Read source. Then Robert Cahn reviews the history of polygonization, a subject to which he made major contributions, and which probably provided the first direct experimental evidence of dislocations. In his closing address, Sir Alan Cottrell reviews the place of dislocations in the main body of physics, the value of dislocation theory in practical metallurgical design, and future directions in dislocation research.

The rest of the volume is devoted to reviews of the present state of our knowledge of the behaviour of dislocations in 'real materials'. The level is uniformly modern and advanced, but few of the distinguished authors have failed to respect the implied injunction.

● *Au & Ag heap and dump leaching practice,* edited by J.B. Hiskey. AIME, 1984. 162 pp. $20 (member), $15 (student member), $30 (non-member) plus $3.50 for postage and handling. (Order from SME Books, Caller no. D, Littleton, CO 80127, U.S.A.).

Reviewer: R.A. Snodgrass

This volume consists of the papers on heap and dump leaching that were presented at a symposium held in Salt Lake City in 1983.

The heap leaching of gold is a topical subject in South Africa at present, with four newly constructed commercial plants in operation. This technology has grown rapidly in the U.S.A. In 1979 heap leaching accounted for 10 per cent of the primary gold production, and this figure rose to 25 per cent in 1983. It must be stressed, though, that heap leaching can be justified only in special applications and is not an alternative to conventional processes.

The papers presented describe various laboratory and pilot-scale test procedures related to all aspects of the design of heap leaching. This includes pad construction, feed preparation, heap design and construction, solution distribution, and metal recovery. Problems encountered in practice, such as those concerning percolation rate, rate of extraction, and solution management, are discussed and solutions proposed.

Papers of special interest compare heap leaching with conventional milling, leaching, and carbon-in-pulp, and also examine process alternatives for the recovery of gold and silver from leach liquors. Although the economics discussed apply specifically to the U.S.A., the comparisons given provide some useful guidelines.

The final chapter is a transcript of a panel discussion concerning the water chemistry of heap-leaching operations, with emphasis on the problems created by scaling and fouling.

In general, this collection of papers provides a valuable insight into the technical and economic aspects of heap leaching.

● *The cost and availability of Colombian coal,* by Eric D. Jamieson, with the assistance of Kathleen Jamieson. London, IEA Coal Research (14/15 Lower Grosvenor Place, London SW1W OEX). £50 (in member countries), £100 (in non-member countries).

Reviewer: W.C. Mather

This report is one of fifty projects commissioned by the International Energy Agency (IEA), and its brief was to examine the Colombian coal industry, particularly the Cerrejon project and its likely impact on the world trade in thermal coal.

The report provides a geopolitical background, with an analysis of the economic, environmental, and energy-development priorities in Colombia. The internal coal market and industry are examined, and the development by Carbocol and Intercor of an export industry based on the Cerrejon coalfield is detailed.

The exercise on the financial viability of the Correjon project in the light of its impact on the world trade in thermal coal indicates that only 16 Mt/a are likely up to the 1990s, with required selling prices of about U.S.$34 to 73 per ton f.o.b. (in 1984 terms), and qualities of about 6620 kcal per kilogram of gross calorific value containing 34,9 per cent volatile matter.

● *Extraction Metallurgy '85.* London, The Institution of Mining and Metallurgy, 1985. £42.

Reviewer: R.A. Snodgrass

This volume contains the 57 papers presented at Extraction Metallurgy '85, a symposium held in London from 9th to 12th September, 1985, with the theme 'Adaptation to Change'. Of these papers, 28 deal with hydrometallurgy, 17 with pyrometallurgy, and the remainder with mineral processing, pollution control, and methods of analysis.

The hydrometallurgical papers cover a wide field and include, among other topics, the recovery of alumina from colliery wastes, the recovery of gold and silver from refinery slimes, the chloride leaching of base-metal sulphides, and an economic comparison of sulphate- and chloride-based processes for complex sulphide ores.

The papers on pyrometallurgy describe various new technologies, including processes for the smelting of copper and lead concentrates. The copper-smelting technology employed by Codelco in Chile involves smelting in reverberatory furnaces with oxy-fuel burners, simultaneous matte conversion, and autogeneous smelting of concentrates in 'Teniente Modified Converters'. Other copper-smelting technologies described include the flame

cyclone reactor, the Contop process, and the Outokumpu flash smelter.

The papers on lead smelting describe the Isasmelt process at Mount Isa, and the Kivcet smelter, which is under construction in Sardinia. The modernization of the Britannia Lead Refinery at Northfleet, Kent, is described, along with an evaluation of modern lead-refining processes.

Four papers deal with pollution control. Of particular interest is a paper dealing with the precipitation of heavy metals from effluents by the use of thiourea.

In general, this volume of papers is a useful reference work for the metallurgist.

2. Recent publications

● *Mining annual review 1985.* London, Mining Journal, Jun. 1985. 600 pp. £26.50 (surface), £39.50 (air).

This volume in the 150th anniversary year of the *Mining Journal* (1835–1985) opens with a review of mining matters over the past one-hundred-and-fifty years. This is followed by a review of metals and minerals during 1984–1985, technical progress reports, and a review of metals and minerals by country.

● *High heat production (HHP) granites, hydrothermal circulation and ore genesis.* London, The Institution of Mining and Metallurgy, 1985. 593 pp. £27 (members), £30 (non-members).

This volume contains the papers that were presented at the conference on the above topics, which was held in London in September 1985.

● *Potential mineral resources of Egypt.* 144 pp. US$10. Available from Bendix Field Engineering Corporation-MPGAP, Box 1237, Grand Junction, CO 81502, U.S.A.

This publication contains the proceedings of the Second MPGAP Seminar, which was held in Cairo in November 1984. (MPGAP is the abbreviation for the Minerals, Petroleum and Groundwater Assessment Program.) The papers give an overview of Egypt's hard-mineral resources, which include gold, polymetallic sulphides, potash, and sulphur, and of many non-metallic commodities, uranium, and oil shale. The research conducted by the Egyptian Geological Survey and Mining Authority, the Desert Research Institute, the Remote Sensing Center, and the Egyptian General Petroleum Corporation as part of MPGAP is also discussed.

3. Mintek reports

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

● **Report M212**

South African costs of equipment for the metallurgical industry (1984).

The relationships between the size or capacity and the average selling price, the mass, and the power consumption of equipment used for metallurgical processing are given in the form of graphs. The prices are those prevailing during the last quarter of 1984.

● **Report M213**

The response of as-rolled 3CR12 steel to heat treatment.

The response of 3CR12, a corrosion-resisting steel, to heat treatment was investigated. The tests were carried out on as-received hot-rolled plates finished in the range 575 to 1025 °C. Heat treatment was applied in the range 575 to 1250 °C, and tensile, impact, and hardness tests were carried out after selected treatments. Optical and electron microscopy were used in the asessment of the microstructure and the fracture surfaces. The volume percentage of martensite in the heat-treated samples was determined by image analysis.

In the range studied, the finish-rolling temperature had no significant influence on the subsequent properties. Heat treatments carried out below 800 °C resulted in the tempering of the lath martensite and in recrystallization, thus yielding a fully ferritic structure. Annealing of the structure at between 800 and 1150 °C resulted in a dual-phase ferrite–martensite microstructure. In the latter temperature range, the volume percentage of martensite, the strength, and the hardness increased with increases in the temperature of the heat treatment, and the toughness decreased. Above 1150 °C, the formation of δ-ferrite coincided with excessive growth of the grains.

Stringers of titanium carbonitride particles that were formed during the rolling did not break up during subsequent heat treatments, and are believed to be instrumental in the delamination process associated with ductile fracture of 3CR12.

A summary of the microstructure and the mechanical properties resulting from different heat treatments is given, from which a heat treatment can be selected for specific requirements.

● **Report M214**

A computer programme for use in the development of multi-element X-ray-fluorescence methods of analysis.

A computer programme (written in BASIC) is described for the evaluation of spectral-line intensities in X-ray-fluorescence spectrometry. The programme is designed to assist the analyst while he is developing new analytical methods, because it facilitates the selection of the following evaluation parameters: calculation models, spectral-line correction factors, calibration curves, calibration ranges, and point deletions. In addition, the programme enables the analyst to undertake routine calculations of data from multi-element analyses in which variable data-reduction parameters are used for each element.

● **Report M221**

Commodity profiles for selected metals.

This report describes the basic characteristics of 35 metals and gives the prices and production of these metals for the period 1979 to 1983/4. The description of each metal includes the ore grades and reserves, the major minerals in which the metal occurs, and the discovery, selected physical properties, sources, uses, substitutes, and effects on the environment of the metal. Graphs showing price and production cover the period 1950 to

1984, and possible future developments in these areas are forecast for each metal until the year 2000.

- **Report M107D**

Upgrading of alaskite rock to feldspathic sand. (First issued Jun. 1983; reissued Nov. 1985).

Batch tests involving magnetic separation and flotation were carried out on a sample of alaskite rock. The objectives of the investigation were as follows:

(a) to remove or reduce the iron-containing contaminants in the rock by the use of a simple, dry process to render the final feldspathic sand suitable for the making of glass,
(b) to upgrade the mica in the alaskite so that it would be acceptable as a filler to the paint and wallpaper industries, and
(c) to examine very briefly the possibility that flotation could be used to yield a product with a high feldspar content.

It was found that, although a sufficiently large proportion of the contaminants can be removed from the alaskite to yield a raw material suitable for the manufacture of glass, certain aspects of the process require further consideration. For treatment by magnetic separation, the sample required reduction to material smaller than about 300 μm, and dry screening of such fine particles is not easy. Also, the dust in the material will have to be removed, preferably by dry cyclones, before magnetic separation is attempted, because screening at 75 μm is extremely difficult.

Mica-rich material can be obtained, but this is very difficult owing to the size of the particles (about 300 μm).

The results obtained by flotation of the ore were not satisfactory.

A revised flow sheet is proposed for the process, and it is recommended that a large representative sample should be mined and that the proposed flow sheet should be tested on a pilot scale. Further work on flotation is also suggested.

The method used for the analysis of the material is detailed in an appendix.

IMM awards

Given below are details of the trust funds to which applications are invited for grants, etc., payable in 1986. Application forms, which must be returned to the Secretary before 17th March, 1986, are available on request. Applicants should note that, in general, preference will be given to members of the Institution.

Bosworth Smith Trust Fund

Approximately £3500 will be available in 1986 for grants from the Bosworth Smith Trust Fund for the assistance of postgraduate research in metal mining, nonferrous extraction metallurgy, or mineral dressing. Applications will be considered for grants towards working expenses, the cost of visits to mines and plants in connection with such research, and the purchase of apparatus.

Stanley Elmore Fellowships

Applications are invited for Stanley Elmore Fellowships, which are awarded by the Institution and tenable at universities in the United Kindom for research into all branches of extractive metallurgy and mineral processing. Fellowships to the value of £1500 to £6000 per annum will be available from October 1986.

Atlas Copco Bursaries

Two Atlas Copco travel bursaries for study tours of Swedish mines may be awarded annually to younger mining graduates. One bursary is open to engineers in any country who have at least 3 years of practical mining experience; the second bursary will be awarded to an engineer who is studying at a British university and has a minimum of one year's practical mining experience. The awards, which were established by the Atlas Copco organization in collaboration with the Swedish Mining Association, will comprise a 3- to 4-week tour of Swedish mining operations in September 1986. Travel expenses from any country will be paid for the first bursar, and from London for the second; accommodation expenses will be met for both. The Council of the Institution of Mining and Metallurgy is responsible for the selection of the bursars, who will be required to present a written report to the Institution before 1st December, 1986, on any aspect of Swedish mining practice, methods, or organization that they found of particular interest.

G. Vernon Hobson Bequest

Applications are invited for awards from the income of the G. Vernon Hobson Bequest, established for the 'advancement of teaching and practice of geology as applied to mining'. It is expected that approximately £2500 will be available in 1986. One or more awards may be made for travel, research, or other objects in accordance with the terms of the Bequest.

Edgar Pam Fellowship

The Edgar Pam Fellowship will be awarded in October 1986 for post-graduate study in subjects within the Institution's fields of interest, which range from exploration geology to extractive metallurgy. Those eligible for the award are young graduates domiciled in Australia, Canada, New Zealand, South Africa, and the United Kingdom who wish to undertake advanced study or research in the United Kingdom. The value of the Fellowship, which is tenable for one year, will be of the order of £1500 to £2000.

Application forms for the Institution awards are obtainable from

The Secretary,
The Institution of Mining and Metallurgy
44 Portland Place
London W1N 4BR
Telephone: 01 580 3802
Telex: 261410.