

Book news

1. Book reviews

● *Tungsten: 1982*. London, Mining Journal Books Ltd, 1982. 179 pp.

Reviewer: G.A. Brown

The Proceedings of the Second International Tungsten Symposium, held in San Francisco in June 1982, are contained in this volume. It was published in co-operation with the Primary Tungsten Association (PTA) and the Consumer Reporting Group (CRG), who were co-sponsors of the Symposium.

These symposia are held regularly every three years, the third meeting being scheduled for May 1985 in Madrid. The first meeting was held in Stockholm in 1979. Both the PTA and CRG were formed to promote the usage of tungsten and the interests of the industry in general, and the objective of holding regular symposia is to bring producers together so that they can confront common problems and issues together, thus serving the interests of the industry as a whole.

The Symposium was attended by 269 delegates from 26 countries representing 140 organizations. Twelve papers were read.

A paper by R. Horton, Director of the U.S. Bureau of Mines, on the strategic and critical materials policy of the U.S.A. opened the proceedings. Although relevant data were presented about the U.S. demand for strategic minerals, the current situation is different and the information is of historical interest only.

A paper by Stafford, also of U.S.B.M., draws attention to the world resource/demand position and concludes that, in the longer term, no shortage of tungsten is expected provided the role played by China remains unchanged.

Of more interest to practising and research metallurgists are the nine papers on the beneficiation and refining of tungsten ores and concentrates. Of particular interest in these days when low-grade deposits are becoming more prevalent is the description of photometric sorting at Mount Carbine, where high recoveries of wolframite are reported from a low-grade feed. R.G. Woolery (Union Carbide) describes process routes that would be applicable to ores of grades less than 0.5 per cent tungsten trioxide, and E. Lassner relates how it is possible to produce marketable ammonium paratungstate from low-grade flotation concentrates produced in a vertically integrated company consisting of mine, concentrator, and refinery.

The potential mine of Amax (Mactung) is described by J. Foreman; it is concluded that it is unlikely to be developed before the late eighties; but the reserves are large and the grade high, and the decision will be based on supply/demand and price considerations. Beneficiation practice in China is described by Wu Weisun: two mills treating mixed scheelite/wolframite ores are described in some detail, with comments on the production of saleable byproducts.

Tungsten chemistry is dealt with comprehensively by M.B. MacInnis, and is of interest to researchers in the field.

The use of tungsten in armaments is a topic that is included in the volume. The contents make interesting reading to the layman, but would be considered valuable data to the specialist. Other uses of hard-metal parts employing tungsten carbide are discussed, together with a treatise on the recycling of scrap with special reference to the zinc process.

In summary, the value of this volume lies primarily in the technical content of three-quarters of the papers presented, and less in the sections dealing with resources, supply and demand, marketing, and financing of new projects. It is therefore a useful reference book on the beneficiation, refining, and uses of tungsten, and is to be recommended to those interested in the metal.

● *The geology of industrial minerals in Canada*, edited by G.R. Guillet and Wendy Martin. Canadian Institute of Mining and Metallurgy, special volume 29.

Reviewer: R.W.O. Kersten

This volume is a sequel to that published in 1957 for the Commonwealth Mining and Metallurgical Congress. While it does not attempt to be a complete catalogue of the industry, it does attempt to cover the highlights and to include not only major producers but significant undeveloped resources as well.

The papers in this volume are arranged geographically, by province and territory. Summaries of industrial mineral activities and recent production statistics are also included for most provinces. If a particular subject is not described in a specific paper, it may be briefly mentioned in one of the provincial summaries.

Individual articles are clearly set out in terms of overall geological setting, detailed geology, genesis of the deposits, and the mining methods used.

Although not of immediate interest to South African geologists, it could be useful to persons involved in the production of industrial minerals and having dealings with North America. It would be a useful addition to libraries wishing to have a complete reference on this subject.

● *Foam flotation — theory and applications*, by Ann N. Clarke and David J. Wilson. New York, Marcel Dekker, 1984. 418 pp.

Reviewer: B.K. Loveday

The authors are specialists in chemistry and environmental engineering, and the book is a review of the theory of the separation of particles or ions by means of air bubbles. The particles can be minerals or precipitates, and the field of froth flotation of minerals is covered in principle. However, the emphasis is very much on the theory, and the vast amount of empirical information on mineral flotation is skimmed over. The main chapters are as follows.

(a) *Precipitate and adsorbing colloid flotation — a review of laboratory scale work* (285 references)

Data on the removal of a number of elements from solution by precipitation and flotation have been extracted from the literature and summarized. In

most instances, these data were obtained in a laboratory on synthetic solutions. No mention of the economics of these methods is made.

(b) *Some fluid mechanical aspects of particle flotation* (13 references)

This deals with the chemical-engineering approach — boundary layer theory, etc.

(c) *Theoretical aspects of particulate flotation* (41 references)

Emphasis is placed on the development of equations using parameters such as surface tension and zeta potential. Many are rather complex equations (e.g. double integrals) that are unlikely to be of use.

(d) *Column design considerations* (49 references)

This chapter develops equations to describe the separation of ions or precipitates in a column, using a chemical-engineering approach with the option of a reflux, calculation of the number of stages, etc.

(e) *Solvent sublation* (20 references)

This process is a non-foaming variant of column flotation using an immiscible solvent to collect the species at the top of the column.

(f) *Review of the literature* (292 references)

In summary, this book may stimulate interest in new applications of separations using air bubbles, but contains a lot of theory and will be of interest only to the academic reader.

● *Industrial and financial indicators of the steel industry*, by Patrick Genevaz. Paris, La Chambre des Cartes, 1982. 2 vols. Vol I: Analysis and conclusions, FF3500. Vol. II: Tables, FF4000.

Reviewer: R.J. Dippenaar

In the study presented in Volume I, the author analyses and compares various financial and industrial aspects of the performance of some forty-two major steel manufacturers over a ten-year period. He pays particular attention to the comparative advantage that certain industrial concerns enjoy within selected markets. Labour-cost and technological differentials are compared, and the interrelation of industrial size, specialization, and diversification as factors influencing competitiveness is discussed. The comparison is done in three major areas: financial results, efficiency, and corporate policy.

Profitability is analysed by the paying of particular attention to such indicators as gross and net profitability, cash-flow ratio, and performance. For example, efficiency is compared with productivity, labour costs, and the efficiency of capital investment. The importance of the installed capacity of a steel plant, the age of such a plant, and the ability to innovate and to automate are discussed as factors influencing the industrial efficiency of a company. The investment policies of different companies are compared, and group policies with regard to concentration and diversification are discussed. Finally, market organization and restructuring are evaluated, particular attention being paid to government protection, the formation of monopolies, and the remodelling of steel plants.

The analysis of industrial and financial indicators is not only valuable to steelmakers, but also serves as a case study of those factors influencing the efficiency and productivity of plants and companies.

Volume II presents the basic data for the analysis developed in Volume I.

● *An encyclopaedia of metallurgy and materials*, by C.R. Tottle. Plymouth, Macdonald and Evans and The Metals Society, 1984. 481 pp. R144,50.

Reviewer: P.T. Wedepohl

To introduce this book, a reviewer could do worse than quote the following extract from a descriptive leaflet:

'The text varies from short definitions to more extended explanations of the background science where this is relevant. Latest findings are included from technology rather than research in order to provide the reader with a condensation of the most up-to-date position possible. Tables are included giving much factual information, incorporating explanations of trade names in addition to mechanical and physical properties. Throughout, the entries are fully complemented by a large number of illustrations'.

This is a fair summary of what the book is about, leaving aside the intriguing implied indictment of research. However, the somewhat dry description gives little hint of the pleasure to be had from the use of the book. Quite apart from the genuine usefulness of the entries, tables, and figures that the reviewer sampled, there is a fascinating wealth of interesting items that are almost compulsive reading. Here are a few samples to whet the appetite: *ferrite ghost*, *rubio iron ore*, *puron*.

Regrettably, the price of the book will prevent all but a few from adding it to their private collections. However, if you know what is good for you, descend to bribery and corruption if necessary to persuade your organizational librarian to acquire the book.

● *The role of crack growth in metal fatigue*, by L.P. Pook. London, The Metals Society.

Reviewer: C.A. Boothroyd

This book is intended as a successor to *Metal Fatigue* by N.E. Frost, K.J. Marsh, and L.P. Pook (Oxford, Clarendon Press, 1974). It is assumed that readers are familiar with the theory of the strength of materials and elementary metallurgy, and that they have some basic understanding of the concept of fatigue. The book concentrates on room-temperature behaviour in air, but contains 340 references and is thus a very useful starting point for an in-depth study of metal fatigue, as well as serving as a concise description of this phenomenon.

The first chapter serves as an introduction both to the subject of metal fatigue and to the book.

The second chapter is a historical survey, reviewing metal fatigue and related subjects, as well as examining the mechanisms of fatigue-crack initiation (slip-band formation) and growth (striations and beachmarks). This chapter also includes a discussion on cumulative damage, and concludes with a section on fatigue testing and data collection.

The third chapter emphasizes the importance of designing against fatigue, and includes practical examples of fatigue assessments in failure analyses, as well as considering some legal aspects.

The fourth chapter deals with the growth of fatigue cracks under constant-amplitude loading, describing the three modes of crack surface separation, the concept of stress intensity (including specific solutions for common geometries), and the effect of specimen thickness on stress state and plastic zone sizes. The analysis of experimental

data and the subsequent use of these data are outlined, and this section includes a table giving data on the growth of fatigue cracks in common engineering materials. Fatigue thresholds are briefly outlined, along with the factors that may affect this parameter, and again there are values for common materials included in tabular form. The problem of short cracks is addressed, indicating that there is a minimum crack size below which stress intensity factors are no longer valid. This chapter concludes with a discussion of some of the factors affecting the propagation rates of fatigue cracks, and shows why it is necessary to undertake experimental investigations in order to establish the fatigue properties of a material.

Chapter five links statistics with fatigue data, including such topics as mathematical descriptions, broad- and narrow-band random loading, scatter, and the analysis of scatter in data on the growth of fatigue cracks. The section on this last subject contains a useful description of how these data can be obtained, and explains the origin of the errors that may be observed.

The sixth chapter deals with the growth of fatigue cracks under non-uniform conditions, and begins with a description of the plasticity effects in the wake of the crack, which can lead to crack closure. Crack growth from an initially stress-free crack is then considered, and it is shown how the range of threshold-stress intensity is affected by crack closure, and hence crack length, owing to the development of the plastic wake. The short-crack problem is re-visited, to show why it would be inappropriate to apply the value of the threshold-stress intensity, obtained from a test specimen containing a long crack, to a practical situation involving a short crack. Crack growth under variable loading and the rainflow method of cycle counting are also discussed.

Chapter seven is a collection of several topics, all of which address the problem of growth direction in fatigue cracks. The transition from square- to slant-crack growth in thin sheets, and the associated shear lips, are first considered, and then the problem of mixed modes under threshold conditions is described. The transition from Stage I to Stage II, crack growth under biaxial stresses, and the change in crack shape as the crack propagates are also covered in this chapter, which ends with a discussion of fretting fatigue.

The final chapter discusses the position of the subject of metal fatigue at present, the avoidance of fatigue failure, and trends in research. There are then two appendices, the first describing, analytically, the elastic stress fields and displacements corresponding to the three modes of relative crack surface movement, and the second showing how S/N curves can be determined.

This is a well-balanced disquisition on metal fatigue, suitable for both practising engineers and academics.

● *Hydraulic coalmining — new technology and its geological and industrial significance*, by H.C. Siebert. Hamm, Zentraldruckerei BAG, 1984. 33 pp.

and

● *Hydraulic coalmining — hydromining update: potential impact on coal deposits and coal mining industry*, by H.C. Siebert. Hamm, Zentraldruckerei BAG, 1984. 130 pp.

Reviewer: L. Wade

These companion publications deal with the role of hydraulic mining in the coal industry. With a world hard-coal production of some 2,8 billion tons per year, hydromining accounts for only about 7 million tons per year, a further 13 million tons per year being transported hydraulically subsequent to more conventional mining methods. The author devotes much effort to explaining why the hydromining technique accounts for such a small proportion of world output, and particularly why it has not been promoted more extensively in countries, such as the U.S.S.R., China, Japan, Canada, and the Federal Republic of Germany, where this method has had isolated but long-standing success.

The author gives explicit criteria for the practical application of hydraulic mining. These criteria include a minimum reserve of 20 million recoverable tons; a depth normally of less than 300 metres; a seam thickness of at least 0,65 metre; a minimum dip of 10 gon at the face (11°); good roof and floor partings; dirt bands comprising less than 10 per cent of the seam thickness, with no band exceeding 0,5 metre; a stable roof, and a gas make of less than 10m³ CH₄/t. Handy tables are also included to enable the workability of a given deposit to be assessed by the use of a weighting formula based on coal hardness, banding, cleating, and other factors.

The author, who has himself been the manager of a hydromine, separates the advantages of hydromining into technical, economic, and safety categories. Major advantages include the absence of moving machines in the working areas; a high degree of flexibility; the possibilities of intergrating the mining and coal-transportation activities; low capital cost; insensitivity to fluctuations in seam thickness; applicability to steep and thick seams; low dust generation; and reduced fire risks due to the absence of conveyor belts. These advantages must, however, be offset against difficulties in the separation of water and coal, high generation of fines, high energy consumption, and poor working conditions resulting from high humidity and difficulties with ventilation.

These publications will be of general interest to most mining engineers, particularly those involved in overseas operations. In the South African context, the technique of hydraulic mining is unlikely to be adopted to any extent, owing to the unsuitability of the coal deposits and the frequent absence of a suitable water supply. Nevertheless, some mines may benefit from the wealth of detail contained in these volumes.

● *Victoria's brown coal. A huge fortune in chancery*, edited by J.T. Woodcock. The Australasian Institute of Mining and Metallurgy, 1984. 204 pp.

Reviewer: J.J. Versluis

This book has a very specific target population. It is not a book to be read from cover to cover, but rather one for the student, the engineer, the scientist, the ordinary citizen who wants to know how and when and why the State of Victoria came to employ its brown coal to such effect. As such, it would also be particularly relevant for any country or enterprise owning similar reserves.

It is not entirely a technical publication, but contains more biography and more history than is usual in Institute

publications. Chapters 1 and 2 are devoted to Sir Willis Connolly, giving tributes to and a short biography of a man who had a career spanning nearly half a century with the State Electricity Commission of Victoria. His achievements are too numerous to mention, but this is a fitting commemoration of a great and dynamic personality.

The rest of the book, Chapters 3 to 7, is devoted entirely to the Victorian brown-coal industry. It takes the reader through the logical sequence of history, geology, discovery, assessment, development of mining technology, combustion for electricity generation, and the role of scientific research and development in the utilization of brown coal.

To quote J.C. Trethowan, Chairman of the State Electricity Commission of Victoria, in a preface to the book, 'Although written by some of the finest professionals that we have at the Commission, the various chapters describe an environment as broad as Victoria itself, part history, part geography, part geology and always, triumphantly, engineering. It is the story of the prodigious endowment which Victoria has in its massive deposits of the humblest of coals and the way in which the State has, within living memory, used this resource to win independence in its energy needs and, indeed, reached the point where it is capable of contributing to the needs of its neighbours'.

In conclusion, although this book has a specific target population, it has enough detail to arouse keen interest in anybody who expects conditions similar to those in Victoria's brown-coal industry, whether in its mining or in its utilization in the generation of electricity.

2. Canadian publications

Obtainable from Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, Canada K1A 0S9:

● The following reviews of the activity and developments during 1982 in respect to the chief minerals produced or consumed in Canada are now available. Prepared by members of the Mineral Policy Sector staff, they are obtainable at \$1.25 per copy.

Aluminium, W. McCutcheon. 12 pp.

General Review, Information Systems Division. 13 pp.

Nickel, R.G. Telewiak. 14 pp.

Platinum metals, S.A. Hamilton. 10 pp.

Silver, S.A. Hamilton. 19 pp.

Tin, G.E. Wittur. 12 pp.

● *Zirconium. An important mineral commodity.* Mineral Policy Sector, *Mineral Bulletin* MR 202, \$6.60.

This report — the fourth in a series intended to provide a basis for the consideration of recommendations and policy options for lowering Canada's vulnerability to possible disruptions in its supply of imported mineral commodities — examines Canada's position in regard to the principal zirconium materials: zircon, fusion-cast zirconium-bearing refractory products, zirconium-bearing chemicals, and zirconium metal, master alloys, and alloys.

● *Canadian minerals yearbook 1982.* Mineral Policy Sector, *Mineral Report* 32, \$40.75.

This issue of the Yearbook is a report of developments in the industry during 1982. The chapters dealing with specific commodities, a general review, a regional review, a list of selected mineral commodities, and a statistical summary were issued in advance as individual loose-leaf reviews.

Obtainable from Printing and Publishing Supply and Services Canada, Hull, Quebec, Canada K1A 0S9:

● *Canadian reserves of copper, nickel, lead, zinc, molybdenum, silver and gold as of January 1, 1983*, by W.H. Laughin. \$4.20. Mineral Policy Sector, *Mineral Bulletin* MR 201.

This Bulletin contains tables and summary illustrations showing the quantities of metal contained in economically mineable (recoverable) 'measured' and 'indicated' ore reserves for each mine or mining company in Canada.

Obtainable from Micromedial Limited, 144 Front Street, Toronto, M5J 1G2 Canada:

● *Sulphur market profile*, by B.W. Boyd. Mineral Policy Sector, MRI 84/5.

Sulphuric acid is the largest-volume chemical commodity produced and is an important part of commerce. Sulphuric acid has been recovered from pyrite and other metal sulphides, and there are still sources where the costs of production and transport are low enough to be competitive with other sources of acid. The containment of sulphur dioxide from smelters for environmental reasons has been an increasingly important issue. Elemental sulphur has been recovered at sour natural-gas plants in Canada, to prevent corrosion of pipelines by the hydrogen sulphide in the sour gas.

3. Mintek publications

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

● **Report M123**

The use of activated charcoal in a NIMCIX column for the recovery of gold from cyanide solutions.

This report is a resumé of the work undertaken during the CHARGOLD project between January 1976 and July 1980.

Investigations were carried out on the recovery of gold by activated charcoal in a continuous ion-exchange (NIMCIX) column from the following solutions:

- (a) an unclarified filtrate from the dewatering filters of a uranium plant,
- (b) an unclarified calcine filtrate,
- (c) a Merrill barren solution from the uranium plant at Vaal Reefs North Gold Mine (West Section), and
- (d) a clarified pregnant solution from Durban Roodepoort Deep Gold Mine.

Barren solutions high in gold were obtained from the unclarified filtrate owing to a rapid build-up of calcium carbonate on the charcoal. This was overcome by regular washing with acid or adjustment of the pH value of the feed. Gold and silver displace the base metals once there is competition for absorption sites. The absorption of gold from Merrill barren solution was poor owing to the high concentrations of calcium on the charcoal. Recoveries of 90 and 99 per cent were obtained from the

unclarified calcine filtrate and the clarified pregnant solution respectively.

The charcoal was successfully eluted with sodium hydroxide followed by washing with water at 90°C. The concentration of sodium hydroxide has no significant effect on the efficiency of elution, although pretreatment for at least 1 hour is essential. The temperature of the stripping water should be as high as possible, but the hardness of the water is not critical.

The charcoal was regenerated in a rotary kiln at a temperature of 800°C. The gold in the resulting eluate was recovered in an electrowinning cell designed at the Anglo American Research Laboratories.

● Report M150

Energy transfer in the hearths of submerged-arc furnaces.

An investigation on the transfer of energy by conduction in the hearths of submerged-arc furnaces is reported, the object being the development of a useful control parameter as an aid in the improvement of furnace performance. Preliminary investigations, including a survey of the literature, showed that techniques using commercially available heat flowmeters had been developed as aids to control furnace linings.

Information was obtained from a 48 MVA ferrochromium furnace by three improvised 'heat-flow sensors', one of which was mounted in the hearth of the furnace beneath each electrode. These sensors were calibrated *in situ* by the use of a commercial heat flowmeter, and the data obtained were used in tests on the technique described in the literature and correlated with other process parameters. The technique described was found to be applicable to ferrochromium submerged-arc furnaces, but careful interpretation of the results and accurate data on the thermal conductivity of ferrochromium are required for its effective application. Also, correlation of the data with other furnace parameters, e.g. electrode position, was not reproducible.

A mathematical model was therefore developed to simulate a wide range of furnace-hearth geometries and materials in two dimensions with time dependence. A computer program to provide numerical solutions for the model was tested satisfactorily against an analytical solution for a highly simplified case. This program may be useful as an aid in the design of industrial linings but could be applied with greater effect in the interpretation of data from small-scale test furnaces.

● Report M151

A preliminary investigation of the initiation of pitting corrosion in austenitic stainless steels and nickel-based alloys.

Pitting corrosion in a number of austenitic stainless steels and nickel-based alloys that differ widely in their resistance to corrosion was studied by electrochemical and electron-optical techniques. The effect of contamination of the sulphuric acid electrolyte by chloride ions was also investigated.

Preliminary results for the surface analysis of samples of 316 stainless steel by Auger electron spectroscopy are presented, and suggestions are included for further application of this technique to the examination of pitting corrosion.

A comprehensive review of the literature concerning the initiation of pitting corrosion is included.

● Report M154

The reduction of Winterveld chrome spinel at 1300°C under an argon atmosphere in the presence of carbon.

The reduction of a mixture of particles of gangue-free spinel in the size range 106 to 90 μm and particles of graphite in the same size range was studied by the use of a recording thermobalance. The partially reduced material was analysed chemically, as well as by X-ray diffraction, optical microscopy, and electron-microprobe analysis.

The reaction is shown to be sequential, the ferric iron being reduced to ferrous iron before a metallic reduction product appears. Almost one-half of the iron is reduced before the reduction of chromium becomes significant, and, by the time about one-half of the chromium has been reduced, almost no unreduced iron remains in the oxide.

Carbon appears in the reduced material after the reduction of chromium has started. The carbon content rises as the reaction proceeds, and beyond the stage at which all the iron has been reduced, the reduced product is an iron-chromium carbide. The product is therefore in a state of near equilibrium with the partially reduced spinel. This indicates that, up to about 60 per cent reduction, the transfer of carbon to the oxide is a controlling factor in the reduction. This conclusion is supported by the observation that the reduced product is confined to the surface of the chromite particle, which retains its external shape while becoming progressively more porous as reduction proceeds. Under hydrogen, a metallic reduction product is formed within the internal pores as well as on the surface.

The second half of the reduction proceeds at a reproducible decreasing rate that can be modelled on the basis of the diffusion of chromium from within the particle to the surface. The initial reduction rate is slow but accelerating, and is not reproducible. Further investigation of this stage of the reduction process is recommended.

● Report M165

The development of an improved on-line gold analyser.

This report describes the development and testing of an improved version of a previously developed on-line analyser, based on atomic-absorption spectrophotometry and electrothermal atomization, to monitor the gold in solutions from the carbon-in-pulp process. Although the complete on-line analyser is not commercially available as a package, all the separate components except the modified furnace autosampler are available.

The operation of the analyser on an extraction plant has shown that the system is accurate, reliable, and economically viable provided that it is properly maintained and supervised.

● Report M167

Three nebulizers for use with an inductively coupled plasma spectrometer.

A crossflow nebulizer and two Babington-type nebulizers are evaluated for use with a high-powered (15 kW) nitrogen-cooled argon inductively coupled plasma (ICP) spectrometer system. The Babington-type nebulizer

designed and constructed in the laboratory was found to be the best in most respects. However, this preliminary study indicates a need for further investigatory work.

4. New publications

● *Mineral Industry Consultants Association (as at 31st March, 1984)*. Parkville (Australia), The Australasian Institute of Mining and Metallurgy, 1984. 112 pp.

Members of the Association are listed according to their fields of expertise, location, company or affiliation, and alphabetically by surname. In the last section, areas of special experience are listed for each member.

● *Philosophical and procedural guidelines for the planning professions*. Johannesburg, the Environmental Planning Professions Interdisciplinary Committee (EPPIC, P.O. Box 61019, Marshalltown 2107), R2.50.

This is a bilingual booklet on the subject. EPPIC believes that environmental impact control is essential but advocates an approach that encourages desirable development, provided the benefits it offers are agreed to justify any unavoidable detrimental effects and thus result in a net improvement to the environment of the community affected. EPPIC also believes that effective and appropriate environmental impact control can be achieved more readily by voluntary adoption of balanced attitudes

and reasonable assessment methods and procedures, than by the enforcement of stringent legislative controls. With the recent adoption of the Environmental Conservation Act, the point has been reached where decisions must be taken regarding which road to be followed. The philosophy and procedures advocated by EPPIC are set out in the booklet, and merit careful consideration by planners, decision makers, environmentalists, and the public in general.

● *Directionally solidified materials for high temperature service*, by M. McLean. London, the Metals Society, 1983. 337 pp.

This book, believed to be the first on its subject, presents the current state of knowledge of both the processing and the behaviour of directionally solidified material. It deals with existing superalloys that are in commercial use, with developmental single-crystal materials and, more speculatively, with *in situ* composites of longer-term potential.

● *Tin and its uses* no. 142. Greenford (England), International Tin Research Institute, 1984.

This issue contains articles on general line packaging in tinplate, organotin-catalysed silicone elastomers, tin and tin-alloy coatings today, and worldwide developments in pewter. Also included are several reviews of books dealing with tin and its alloys.

Metals engineering

International Symposia & Exhibitions Ltd — a subsidiary of Industrial Newspapers PLC — are pleased to announce that they will be organizing a mammoth engineering event, entitled Metals Engineering 86, comprising five important exhibitions in 1986:

Castings and Forgings 86

Foundry 86 International

Furnaces 86

Metallurgical Plant 86

Metalworking 86 International.

Each of these will form part of Metals Engineering 86. Two other major exhibitions, Metcut 86 and Subcon 86, will be running concurrently, and there will be a common visitor entrance to all seven exhibitions.

It is expected that at least 800 companies will be ex-

hibiting their goods and services to a worldwide audience of more than 100 000 visitors.

This event will be staged at the National Exhibition Centre, Birmingham, England, from Monday to Friday, 1st to 5th September, 1986.

Metal Engineering 86 will be part of Industry Year 1986, initiated by the Royal Society for the Encouragement of Arts, Manufactures and Commerce. The aim of Industry Year 1986 is to encourage a better understanding of industry, its essential role and its service to the community, and to win acceptance for it.

For further information, please contact J.E. Clarke, Managing Director, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, England. Telephone: 0737 68611. Telex: 948669 Topjnl G.

Agglomeration

A major symposium on agglomeration is being organized in Toronto for the 2nd to 5th of June, 1985. Speakers from around the world (Canada, U.S.A., Brazil, Australia, Japan, West Germany, Italy, India, China, Switzerland, Poland, Yugoslavia, and France) will address delegates on various aspects of agglomeration relative to iron ore, coal, coke, and fuels. Plenary theme papers will also be presented by speakers from Japan, the U.K., and the Netherlands.

In conjunction with this Fourth International Symposium on Agglomeration, specialized short courses will

be offered from 30th May to 1st June on the campus of the University of Waterloo. The subjects will be the fundamentals of cokemaking and agglomeration.

The co-sponsors of this Symposium are the Iron and Steel Society of AIME and The Canadian Institute of Mining and Metallurgy, in cooperation with the Society of Mining Engineers of AIME.

For further details contact Prof. J.R. Wynnyckyj, Department of Chemical Engineering, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada.