Book reviews

Alexander Sutulov. *Mineria Chilena 1545-1975* (Mining in Chile 1545-1975). Santiago, Centre of Investigation of Mining and Metallurgy, 260 pp. (In Spanish).

This book is a historical synthesis of the production of metals, metallic and non-metallic concentrates, and fuels in the territory of Chile since that country came to exist as a nation.

In this publication the following five periods are considered:

1. Colonial period (1545–1810)
2. After Independence (1810–1900)
3. 1901–1925
4. 1926–1950
5. 1951–1975

A forecast of the mineral production for the last quarter of the twentieth century is also given.

Apart from analysing the physical production of gold, silver, copper, nitrate, coal, etc., this book, for the first time in Chilean literature, gives a comparative economic evaluation of mineral production in historical prices as well as in U.S. dollars at their 1975 value. Thus, the reader can appreciate the real dimensions of the figures presented.

The great challenge that the last quarter of this century represents in terms of mineral production, and the significance that copper has as the key to national development, are also shown.

The book contains 93 black-and-white photographs, 4 diagrams, and 14 tables. Appendix A gives 21 tables dealing with statistics on historical mining and Appendix B contains indexes and prices. E.J.M.

G. B. Rothenburg. *Speciality steels*. U.S.A., Noyes Data Corp., 1977. 270 pp.

Eliminating legal jargon and other irrelevancies, this book concisely records the details of 180 patents relating to steels that were issued in the U.S.A. from late-1974 to mid-1976.

The coverage is 21 carbon steels, 15 low-alloy steels, 35 tool steels, 41 stainless steels, 16 heat-resistant steels, 15 low-carbon construction alloy steels, 15 silicon steels, and 22 general steelmaking processes. The book clearly achieves its aim of presenting an advanced, technically oriented review of special steels in the mid 1970s and earns its place on the shelf of a technical library.

The rights of the patent holders are recorded unambiguously, and the author and the publisher of the book disclaim any liability for damage arising from abuse of their subject matter. H.B.

Witbank/Middelburg Branch

A General Meeting was held at the Witbank Golf Club on 20th April, 1977, at 17h30.

Present

Fellows 2; Members 11; Associates 3; Graduates 2; Visitors 13.

Proceedings

The Chairman, Mr Jackson, welcomed the speaker, Mr Clyde Sutherland, Manager of Arnot Colliery, and expressed his appreciation for the good turn-out of members and visitors.

Mr Sutherland then dealt with the paper on open-cast coal mining, which had been jointly written by Messrs Rankin and Dickson. It was illustrated with plans, photographs, and slides. The intense interest in the subject was demonstrated by a prolonged question period, which the speaker handled extremely well.

Mr N. Coetzee of General Mining thanked Mr Sutherland for his contribution.

The meeting closed at 19h30.

Treatment of waste water

An International Research Symposium on New Processes of Waste Water Treatment and Recovery is to be held in London from 6th to 8th September, 1977. It is being sponsored by the Society of Chemical Industry Water and Environmental Group in collaboration with the Environmental Group of the Chemical Society.

Both industrial and sewage wastes will be covered in a comprehensive presentation of the latest research in these fields, the general subject groupings being

Gas transfer/aerobic biological treatment processes
Anaerobic biological treatment processes
Physicochemical treatment operations
Sludge treatment
Protein recovery from wastes.

All enquiries should be directed to The Conference Secretary, Society of Chemical Industry, 14 Belgrave Square, London SW1X 8PS.

NIM reports

The following reports are available free of charge from the National Institute for Metallurgy, Private Bag X3015, Randburg, 2125 South Africa.

Report no. 1708

An examination of the suitability of various reducing agents for the production of ferrochromium. (27th Feb., 1975; re-issued May 1977).

The report gives the results of various tests on the suitability of pea coke, Lurgi char, and Rand Carbide char as reducing agents in the production of charge chromium. The physical properties of the reducing agents were determined mainly by the Fuels Research Institute, and the variation of electrical conductivity with temperature was measured at the National Institute for Metallurgy.

In addition, pea coke and Lurgi char were examined, for their suitability to the production of charge chromium, in furnace No. 1 at Palmiet Chrome, Krugersdorp. The results showed that Lurgi char is a suitable reducing agent from the point of view of its electrical and production characteristics but that the phosphorus content of the metal product is too high.

Report no. 1724

The preparation and reduction of chromite pellets containing a reducing agent. (14th Apr., 1975; re-issued Mar. 1977).

The pellets investigated were prepared from chromite and selected amounts of carbon in the form of char, and were heated to temperatures of 1100, 1200, 1300, and 1400 °C. In general, the effect of char additions to the pelletizing meal was a reduction of physical properties.

Some 75 per cent prereduction could be obtained on pellets containing the full stoichiometric requirement for reduction when these were heated to temperatures of 1300 °C and higher for a period of 2 hours.

The smelting of prereduced pellets led to no difficulties, but problems in the tapping prevented the calculation of mass balances.

Measurements of electrical conductivity on smelting charges containing prereduced pellets showed a decrease in electrical conductivity with increase in the degree of metallization of the pellets, except where the pellet charge had been prereduced for 4 hours.

Report no. 1854

The interaction of pyrite, oxygen, and xanthate. (8th Mar., 1977).

The interaction between pyrite, potassium ethyl xanthate, and oxygen was studied in a circulation apparatus. The results show that a clean pyrite surface continues to abstract oxygen and xanthate from solution as long as both of these are present in solution. The xanthate reacts to form both adsorbed products and soluble ethyl monothiocarbonate, and it is postulated that a small amount of an adsorbed ferric hydroxyxanthate is formed in addition to the predominent dixanthogen. From a consideration of the effects of pH and of xanthate and oxygen concentrations on the rates of formation of the different products and the relative amounts of oxygen consumed in their formation, tentative mechanisms for the reactions are proposed. It is postulated that the formation of ethyl monothiocarbonate involves the ferric hydroxyxanthate species.

When preoxidized pyrite is introduced into oxygen-free xanthate solution, some ethyl monothiocarbonate is formed but no adsorption takes place. However, when a prexanthated pyrite sample is introduced into oxygen-free water, some ethyl monothiocarbonate is formed, and a large proportion of the remaining adsorbed xanthate is released into solution in the form of the xanthate ion.

Report no. 1876

The ultrasonic determination of the mud level in a thickener and the resin level in an ion-exchange column. (6th May, 1977).

Two ultrasonic instruments having the same principle of operation were evaluated as detectors for the mud level in a thickener and the resin level in an ion-exchange column.

The Hecta echo sounder, a ship's echo sounder that had been converted by the factory to have a range between 0,4 and 3 m, operated well for detection of the mud level in a thickener but was unable to operate in a resin column. The Wesmar interface detector, which was specifically designed for mine installations, operated well in the thickener and in a resin column.

An optical probe was constructed for calibration in a thickener, but was not used in the resin column because there were grids inside the column that, at certain times, were exposed when the level of the resin fell, and hence these were used for calibration.

Report no. 1878

The electrochemical dissolution of galena in aqueous solutions. (5th May, 1977).

The anodic and cathodic behaviour of galena in various aqueous solutions was studied, as well as the effect of pH on the anodic dissolution of galena in solutions of perchlorate, chloride, sulphate, mixed perchlorate and chloride, and mixed chloride and sulphate. Steady-state potentiostatic experiments on a galena rotating-disc electrode in perchlorate solutions indicated that the primary reaction governing the anodic dissolution is

$$PbS \rightarrow Pb^{2+} + S + 2e.$$

A mechanism involving a sulphur intermediate is proposed for this process. Cyclic-voltammetric studies with the use of rotating ring-disc electrodes revealed that the morphology of the sulphur deposit has a bearing on the active–passive behaviour of galena. In sulphate and perchlorate solutions at pH values above 4, the species responsible for the passivation of the galena surface are shown to be the basic lead sulphates $PbO \cdot PbSO_4$ or $3PbO \cdot PbSO_4$, or both. In chloride solutions, the passivating species is probably $PbCl_2$.

The reduction of galena leads to the production of lead metal and hydrogen sulphide, but it appears that the accumulation of lead on the surface does not reduce the activity of the galena towards further reduction. Possible mechanisms for the cathodic reactions are proposed.

Report no. 1881

n-Octylaniline, a new extractant for noble metals. (28th Mar., 1977).

A limited investigation was made of *n*-octylaniline as a group extractant for small amounts of noble metals in the presence of large amounts of the base metals commonly present in platinum-bearing materials. In the analysis of a low-grade matte-leach residue, *n*-octylaniline quantitatively extracted the noble metals, with the exception of rhodium. It was found not to extract copper, nickel, iron, cobalt, arsenic, and tellurium. Small amounts of zinc, selenium, chromium, and tin are extracted, and only bismuth, lead, and antimony are extracted to any considerable extent.

Report no. 1883

The determination of iron, chromium, titanium, and tungsten by X-ray-fluorescence spectrometry. (31st Mar., 1977).

An accurate and precise method is described for the determination of iron and chromium in chromite, iron and titanium in ilmenite, and tungsten in tungsten ores.

Samples are prepared for analysis by fusion with sodium peroxide or sodium tetraborate and by leaching of the melt in a solution of tartaric or hydrochloric acid.

Matrix correction and calibration are achieved by means of the single-standard calibration method with reference solutions prepared from compounds of the elements determined.

Report no. 1889

Entropy relations in the formation of complexes of silver (I), mercury (II), and cadmium (II) with monodentate ligands. (5th May, 1977).

The standard changes in free energy, $\Delta G°$, enthalpy, $\Delta H°$, and entropy, $\Delta S°$, at 298,15 K for the reactions involved in the formation of complexes between some of the cations Ag^+, Hg^{2+}, and H^+ with the ligands 3-cyanopyridine and piperidine were measured by glass-electrode potentiometry and titration calorimetry. In addition, $\Delta H°$ and $\Delta S°$ for the system Hg^{2+} and pyridine were redetermined, and previously reported values involving the ligands diethanolamine and imidazole were recalculated, account being taken of the effect of protonation of the ligand in the background electrolyte.

These results, together with other results for the complexes of Ag^+, Hg^{2+}, and Cd^{2+} published previously, show that, to within experimental error, with Ag^+ as the reference metal ion, a correlation exists between the entropy changes on complex formation involving these metal ions. The existence of linear entropy relations of this type, having a slope close to unity, can be rationalized in terms of the Powell, Latimer, and Cobble theory. Deviations from theoretical behaviour are discussed in terms of incomplete desolvation of the metal ions on complex formation to form metal–double ligand complexes.

Mechanics of granular materials

A conference on the above subject is to be held in London on 8th and 9th September, 1977, under the auspices of the Institute of Mathematics and Its Applications.

The objective of this meeting is to bring together chemical engineers, engineers working in soil mechanics, and applied mathematicians to discuss theoretical aspects of both the deformation and flow of granular materials and associated applications in the hope of discovering and developing common interests.

There is now available considerable experimental evidence about the mechanics of such materials; but theories are rudimentary and often do not fit the facts. The applications are varied and the special geometrics of pipe flows, bunker design, and the stability of tips have attracted considerable attention. Survey lectures will be given by both a chemical and a civil engineer indicating the need for, and the constraints on, mathematical models of granular materials; in addition, there will be a survey lecture on the application of plasticity theory. Shorter talks and discussion periods will attempt to highlight special problems and areas of potential significance.

Invited speakers will include

Mr R. A. Ashbee (CERL, Leatherhead)

Dr J. Bridgewater (University of Oxford)

Dr I. F. Collins (UMIST)

Professor G. de Josselin de Jong (Delft University of Technology)

Dr B. Scarlett (University of Technology, Loughborough)

Dr A. E. Skinner (Imperial College of Science and Technology)

Dr J. C. Williams (University of Bradford).

Further details can be obtained from The Secretary and Registrar, The Institute of Mathematics and Its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex, SS1 2JY, England.