ABSTRACTS

(A) General

1. Evaluation of the fibre-clad type lead-acid cells—

S. Hisano (J. Electrochem. Soc., Japan, **31**, 178, 1963). Tests have been performed for 10 years off and on, and the life of the fibre-clad type cells was examined. The larger capacity and the longer life were confirmed in the laboratory tests, but the service test for train-lighting produced somewhat negative results. Six tables, 9 figures and 2 references.

2. How corrosion affected design of Candu—

D. G. Boxall (Canadian Chem. Processing, **48**, No. 5, 69, 1964). Many first-time problems had to be resolved in the design of the Canadian-type nuclear power reactor. Here's an outline of the materials specified and why they were chosen: Introduction, maintenance is complex, specific problems, no leaks allowed, choosing the pressure tubes, housing the fuel pellets, avoiding crud formation, pH for aluminium and carbon dioxide atmosphere. One table, 5 figures and 6 references

3. Metals protection in the marine environment

L. J. Nowacki and W. K. Boyd (Battelle Tech. Review, **13**, No. 6, 9, 1964). Review of established protective systems and discussion of new approaches to the protection of such structures: anticorrosion protection through organic coatings, anti-fouling coatings, cathodic protection, prospects for the future. Figures and 5 references.

4. The atmospheric corrosion behaviour of aluminium and aluminium alloys—

P. Drodten (Werkstoffe u. Korrosion, **15**, 464, 1964). Important characteristics of the corrosion behaviour of aluminium and its alloys, influence of different types of atmosphere, protective layer formation; practice experience, protective and special maintenance measures.

5. Recent advances in cathodic protection of ships—

N. S. Dempster (Australasian Corrosion Engg., **8**, No. 6, 9, 1964). Introduction, general, considerations, galvanic systems, impressed current systems, underwater paints, future developments. Two tables, 8 figures and 9 references.

6. Practical considerations of water soluble corrosion inhibitors—

R. Ings (Australasian Corrosion Engg. ,**8**, No. 6, 21, 1964). Corrosion inhibitors, applications, dosage equipment.

7. Passivity of chromium and stainless steel in hydrofluoric acid—

C. C. Seastrom (Corrosion, **20**, 179t, 1964). Anodic polarization of chromium shows that the metal can be protected in 10 per cent hydrofluoric acid. The corrosion rate of stainless steel in this medium can be reduced by anodic protection but less than is possible in sulphuric acid. The dissolution rate of passive stainless steel in 5 per cent hydrofluoric plus 40 per cent sulphuric acid is similar to the rate in 5 per cent hydrofluoric acid. The break down of the passive film on stainless steel probably is accelerated by the formation of stable ferric fluoride complex ions. Two tables, 6 figures and 31 references.

8. Principles of stress corrosion cracking as related to steels—

F. J. Bates and A. W. Loginow (Corrosion, **20**, 189t, 1964). General review of stress — corrosion cracking phenomena confronting design, operations, maintenance and research engineers. Two tables, 10 figures and 31 references.

9. Anodic protection of carbon steel in black sulphuric acids—

C. E. Locke, W. P. Banks and E. C. French (Materials Protection, **3**, No. 6, 50, 1964). Anodic protection was shown to be effective in controlling corrosion of mild steel in a variety of common black sulphuric acids. Laboratory tests have been substantiated by field applications.

10. Anodic protection of kraft digesters—

T. R. B. Watson (Materials Protection, **3**, No. 6, 54, 1964). Describes corrosion problems encountered in kraft digesters used in pulp and paper industry. Explains how anodic protection equipment is used to maintain a passive film on digester shell's interior surfaces during cooking cycles to prevent corrosion. Economic data on installation and operation of anodic system, plus savings from prevention of failures and reduced maintenance.

11. Chromate passivation of zinc—

S. R. Addanki and A. K. Lahiri (NML Tech· J., **6**, No. 3, 10, 1964). Chromate passivation greatly increases the corrosion resistance of zinc, and the properties of the film formed is dependent mainly on acid concentration. On galvanized steel the film is in general less adherent than on zinc and zinc-plated steel.

12. Application of the polarization resistance technique to corrosion monitoring—

P. Neufeld (Corrosion Science, **4**, 245, 1964). A simple method of making measurements with the polarization resistance technique has been developed, making it usable for plant corrosion monitoring. Its effectiveness has been demonstrated by comparing the results with potential time curves. The processes of film breakdown and repair are shown to be accompanied by corresponding variations in corrosion rate. Data are presented for mild steel in hydrochloric and other acids, aluminium in sodium chloride, and stainless steel in sulphuric acid.

13. Dissolution of manganese in acids—

T. Hurlen and T. Valand (Corrosion Science, **4**, 253, 1964). Measurements have been made of the corrosion rate and corrosion potential of manganese in chloride and sulphate solutions of pH 0-3.

14. New look at corrosion fundamentals—

J. G. Parr (Chem. Engg., **71**, No. 14, 160, 1964). Introduction, the activation barrier, Pourbaix diagrams, getting down to atoms, how metal structure affects corrosion; 6 references.

15. Corrosion in surgical implants—

J. H. Hicks (Chemistry and Industry, 1240, 1964). Uses of metal in the body, conditions favouring corrosion, requirements and uses, screening tests, toxic effects, alternatives to stainless steel.

16. Mechanism of metal protection by volatile inhibitors—

I. L. Rosenfeld, B. P. Persiantseva and P. B. Terentiev (Corrosion, **20**, 222t, 1964). Mechanism of protection by volatile inhibitors; data on hexamethylneimine and its salts-benzoates, nitrobenzoates, etc. Three tables, 6 figures and 17 references.

17. Electrodeposition of iron-zinc alloys. Production from sulphamate baths—

S. S. Misra and T. L. Rama Char (Metal Finishing, 62, No. 6, 88, 1964). Iron has been codeposited with zinc from the sulphamate bath. Detailed studies on alloy composition, cathode efficiency and potential have led to the optimum conditions for obtaining plates containing 0-89 per cent iron. There were sudden changes in deposit composition for a small variation in current density corresponding more or less to the deposition of alloys of different phases. Four tables, 11 figures and 23 references.

18. Electrodeposition of cobalt. Structure and physical properties of deposits—

F. R. Morral (Metal Finishing, **62**, No. 6, 82; No. 7, 59, 1964). Crystalline structure of electrodeposits, microstructure-optical and electron beam, mechanical properties of deposits. Magnetic properties, conclusions; 60 references.

19. Science for electroplaters 89. Chromium: fluoride—flouosilicate baths—

L. Serota (Metal Finishing, **62**, No. 6, 94; No. 7, 65, 1964). Historical, mixed catalysts. Self-regulating baths, activating effect, crack-patterns, corrosion resistance.

20. Recovery of metals from pickles—

M. Straschill (Galvanotechnik, **55**, No. 1, 42, 1964). Process of electrodepositing copper, chromium and zinc in used sulphuric pickles while simultaneously regenerating the acid. The electrolytic regeneration of used chromate dip is discussed.

21. Advances in electroplating decorative, microcracked chromium—

W. H. Safranek and H. R. Miller (Plating, **51**, 543, 1964). The outdoor corrosion resistance of nickel and chromium electroplated panels and parts has been greatly improved by utilizing microcracked chromium with a continuous network of cracks, resolvable with a

magnification of not less than 100. The crack pattern is obtained in the chromium plated in recesses and on high current denisty areas with sodium selenate added to a chromic-sulphuric-fluosilicic acid plating solution.

22. **Tin plating of lead by immersion**—

F. A. Lowenheim (Plating, **51**, 551, 1964). Lead and lead-base alloys can be tinned by immersion in a hot, acidified solution of stannous chloride. The solution can be regenerated by cooling to precipitate out the lead chloride formed.

23. **ASTM Standards — A guide to industry. Recommended practice for preparation of and electroplating on aluminium alloys**—

(Plating, **51**, 559, 1964). Procedures for plating of brass, cadmium, copper, chromium, gold, nickel, silver, tin and zinc.

24. **Alloy deposition — Part 3. Alloys for wear resistance and low friction applications. Part 4. Deposits for electrical contacts**—

N. V. Korovin (Electroplating and Metal Finishing, **17**, 188, 249, 1964). Alloys of iron, chromium and lead; nickel-cobalt; 4 figures, 8 tables and 55 references. Deposits for electrical contacts.

25. **The conditions of the joint electrodeposition of metals with the formation of an alloy**—

B. I. Skirstymonskaya (J. Applied Chem., USSR, **36**, No. 4, 772, 1963). The fundamental thermodynamic conditions leading to the displacement of the deposition potentials of the components of the alloy are examined and the kinetic conditions of the joint deposition of 2 metals at a cathode are studied. Three figures on partial polarization curves for the copper-zinc system; 21 references.

26. **Experiments on the electrodeposition of manganese from chloride solutions**—

V. V. Stender and Yu. M. Loshkarev (J. Applied Chem., USSR, **36**, 984, 1963). A study was made of the effect of the common variables and certain additives on the current efficiency and structure of cathode deposits. Short-duration electrolysis can be carried out at high current densities, 3000-4000 A/m^2, the efficiency being 80-90 per cent. Two tables, 5 figures and 24 references.

27. **Preparation and evaluation of clean metal surfaces**—

H. B. Linford (Corrosion, **20**, 213t, 1964). Contaminants on metal surfaces — hydrophobic and hydrophilic, and usual methods for their removal; quantitative comparison of the various tests available for the resulting cleanliness. One table, 4 figures and 12 references.

28. **Fluid-bed coating**—

P. W. Sherwood (Product Finishing, **17**, No. 2, 82, 1964). Use of fluid bed coating for tanks, valves, pipes, metal furniture, fan guards and kitchen finishes. Discussion of resin, preparation of substrate, coating and finishing conditions.

29. **Fluid bed process: A new technique to obtain diffusion coatings**—

R. J. Wood (Materials Protection, 3, No. 7, 25, 1964). Describes a new fluidized bed technique for coating refractory alloys within 3 hours time. Oxidation resistance of disilicide coatings are discussed. Testing coatings in high temperatures and procedures for coating refractory parts also are included. Coatings were tested in environments simulating those which can be encountered by re-entry space vehicles. At atmospheric pressure, a 1.5 mil disilicide coating on molybdenum, 0.5 titanium, 0.07 zirconium or on columbium, 10 titanium, 5 zirconium protects parts for 4 hours or more at 2700 F and for more than 2 hours at 3000 F. The coating has been tested at 1600 to 2500 F for 8 to 10 hours without failure. Seven references.

30. **Modern carbide furnaces**—

H. Walde (Chem. Age of India, **15**, 831, 1964). Basic design of the closed furnace, raw materials and furnace operation, ancillaries, conclusion. Two figures, 5 tables and 6 references.

31. **Mineral resources of the sea**—

J. L. Mero (Trans. New York Acad. Sci., Ser. II. **26**, 525, 1964). Review with references and tables on reserves of 60 elements.

32. **Titanium mineral industry in India**—

R. A. Chansarkar (The Eastern Metals Review, **17**, 961, 1964). Ilmenite and rutile, main use of ilmenite, fall in exports, ilmenite prices; 4 tables covering statistics.

33. **Ion exchange in extractive metallurgy**—

R. E. Anderson (Chem. Engg. Reviews, **60**, No. 48, 76, 1964). Some of the factors in-

volved in a successful application of ion exchange in extractive metallurgy are presented in relation to several new promising processes such as magnesium from sea water, gold from cyanide solutions and lithium from spodumene. Three figures and 31 references.

34. **The application of nuclear energy to power desalination processes**—

J. B. Clampett (Australian Chem. Engg., **5**, No. 6, 9, 1964). This paper discusses the nature of the input energy to several of the more important desalting processes including electrolysis, and indicates the possible methods of using the energy available in nuclear fuels to power such processes. Four tables including economics, 10 figures and 7 references.

35. **Chemical activation**—

B. S. Rabinovitch and M. C. Flowers (Quarterly Reviews, **18**, 122-168, 1964). Review with 104 references: general characteristisation, survey of occurrence, and specific studies of chemical activation.

—T.L.R.

(B) Theoretical Electrochemistry

1. **The mechanism of electrochemical oxidation of carbon monoxide and methanol on platinum. The reactant-pair' mechanism for electrochemical oxidation of carbon monoxide and methanol**—

S. Gilman (J. Phys. Chem., **68**, No. 1, 70, 1964). The 'reactant-pair' mechanism assumes that the activated complex in the loss of the first electron from carbon monoxide involves an adsorbed carbon monoxide molecule adjacent to an adsorbed water molecule. A similar mechanism may be involved in the electrochemical oxidation of methanol in the acid solutions and other simple organic molecules at the lower range of overvoltages.

2. **Bivalent thallium and the mechanism of the electrode reaction $Tl^{a+} + 2e \rightleftarrows Tl^{+}$.**—

H. A. Catherino and J. Jordon (Talanta, **11**, No. 2, 159, 1964). Conclusive evidence is presented that the electrooxidation of the aquo monovalent thallium ion and the electroreduction of tervalent thallium ion proceeds via a bivalent thallium species. In molar aqueous perchloric acid the rate of the disproportionation process, $2Tl(II) \rightarrow Tl^{+} + Tl^{a+}$ is relatively fast compared to the electron transfer steps, $Tl(II) + e \rightarrow Tl^{+}$ and $Tl^{a+} + e \rightarrow Tl(II)$.

3. **Electrolytic formation of insulating oxide films on zirconium. Electrode kinetics at constant voltage**—

G. C. Wills, G. B. Adams and P. Van Rysselberghe (Electrochim. Acta, **9**, No. 1, 93, 1964). The kinetics of formation of insulating oxide film on zirconium electrode at constant voltage were used to test two theoretical expressions, Mott-Cabrera and Dewald theories, for metal oxide film formation kinetics. Interfacial and internal barrier heights and half jump distances were calculated. Some evidence is presented for variation of the concentration of metal surface active sites with film formation rate.

4. **Elucidation of the mechanism of electrolytic hydrogen evolution by the use of H-T separation factors**—

J. O'M Bockris and S. Srinivasan (Electrochim. Acta, **9**, No. 1, 31, 1964). Tafel parameters and H-T separation factors were determined on various metals in acid and alkaline solutions. The slopes greater than 2RT/FV are due either to adsorption of organic compounds or to the presence of conducting films. The mechanisms indicated are slow recombination on platinum and rhodium in acid solution, slow electrochemical desorption on copper and nickel in acid and platinum in alkaline solutions, slow discharge-fast-recombination on nickel and tungsten in alkaline solution, linked discharge-electrochemical desorption on mercury, lead (discharge rate determining) and cadmium (electrochemical desorption rate determining).

5. **Some theoretical considerations of quasi-reversible and irreversible electrode reactions in oscillographic square-wave polarography**—

Koichi Okamoto (Bull. Chem. Soc. Japan, **36**, No. 11, 1381, 1963). The magnitude of the transfer coefficient and reaction rate influence the polarographic wave of quasi-reversible reaction. The theoretical equations of irreversible waves in the cathodic and anodic sweep processes have been derived. The wave height of the irreversible electrode depends on transfer coefficient and is much lower than that of the reversible reaction.

6. **Kolbe electrolytic synthesis. Theoretical investigation of the mechanism by standard potential calculations**—