Introduction, special conductors, other conductors, accessories, aluminium busbars. Two tables and figures.

29. **Electrolytic chlorine and caustic soda industry in Japan. I —**

H. Tsukada and coworkers (J. Electrochem. Soc., Japan, **32**, No. 1, 1, 1964). Review under special features, production techniques, research and technical development; 44 references.

30. **Anodic polarization of sintered silver electrode in alkaline solution: Efficiency of charging —**

P. B. Mathur and R. Gangadharan (Indian J. Tech., **2**, 331, 1964). Polarization data show that silver electrodes can be charged without loss of efficiency at the first oxidation stage up to a charging rate as high as 2.2 amp. hr. but not at the second oxidation stage.

31. **Electrochemical behaviour of manganese: dissolution, deposition, hydrogen evolution —**

T. Hurlen and T. Valand (Electrochimica Acta, **9**, 1077, 1964). Manganese dissolution and deposition and hydrogen evolution at manganese electrodes in aqueous chloride and sulphate solutions have been studied by a slow galvanostatic technique. Tafel lines have been obtained for the steady-state dissolution and deposition. The hydrogen evolution reaction is found to be under diffusion control.

32. **A better method for determining trace metals in nickel solutions —**

R. G. Shafto (Products Finishing, **28**, No. 11 138, 1964). How to use atomic absorption spectrophotometry for fast, accurate, measurement of trace metal concentration — copper, iron, lead and zinc.

33. **The determination of trace elements in electroplating solutions by atomic absorption spectroscopy —**

C. M. Whittington and J. B. Willis (Plating, **51**, 767, 1964). The general principles are discussed, together with the procedure for the rapid analysis of copper and zinc impurities in a Watts type nickel solution. The new method is simple, rapid and accurate, and should be capable of extension to many other analyses in the electroplating industry. Seven tables, 5 figures and 10 references.

34. **ASTM Standards - a guide to industry —**

(Plating, **51**, 788, 1964). Recommended practice for preparation of and electroplating on stainless steel.

35. **Changing patterns in research —**

D. C. Minton (Battelle Tech. Review, **13**, No. 7, 9, 1964). The total expenditures in the U.S.A. for research and development are in an incipient stage of a tapering off process. Industry - financed research will probably continue its current rate of growth while expenditures in government move toward stablization. Also considered are the effects of the tapering off process on industry, research and manpower needs. Five figures and 7 references.

— T. L. R.

(B) Corrosion

1. **The corrosion of uranium, zirconium, and some alloys in alkaline solutions —**

J. S. L. Leach and A. Y. Nehru (J. Electrochem. Soc., **111**, 781, 1964). The corrosion of uranium, zirconium and uranium—zirconium alloy was studied as a function of potential in some alkaline solutions. The interpretation of the data for uranium and the alloy involved assumptions concerning changes in the nature of the protective oxide layer associated with changes in the formation potential. Such differences are not shown on the pH-potential diagram generally accepted for the uranium-water system and a new diagram has been derived. Electron diffraction measurements were employed in an attempt to verify the present interpretation.

2. **The effect of heat-treatment on the corrosion and hydrogen pick up behaviour of a zirconium-tin-niobium alloy in high temperature water and steam —**

D. L. Douglass and H. A. Fisch (J. Electrochem. Soc., **111**, 787, 1964). Heat-treatment was shown to increase the rate of corrosion of Zr-2Sn-2Nb over that of the annealed condition, but the rate of hydrogen pick up as a function of total corrosion was found to be relatively insensitive to heat treatment. The effects of heat treatment have been analysed in terms of changes in: (1) alloy constitution, (2) composition of microconstitituents, and (3) the metal structure and oxide orientation.

3. **Corrosion processes and new developments in the protection of underground structures against corrosion —**

W. Kirsch (Metal-Reinig. Vorbehandl, **13**, 9,

1964). The corrosion of underground structures, being chiefly an electrochemical process, varies greatly with the specific resistence of the soil; 10^4 ohm·cm. is considered relatively harmless, while 10^1 ohm-cm. is rather harmful. A four-electrode apparatus for the measurement of the specific resistance of the soil is described. The mechanism of the corrosion process, including the corrosion due to long line currents and to stray currents, and also the materials used for industrial structures are discussed.

4. The corrosion of iron in acid solutions containing nitrate ions —

R. Moshtew, E. Budevski, and N. Khristova (Corrosion Sci., 3, 125, 1963). The dissolution of pure iron in 0.1M Na_2SO_4 + 0.16M $NaNO_3$, neutralised with sodium hydroxide to pH 2.50, in a rotating disk electrode apparatus showed the process to be limited by mass transport of hydrogen or other ions acting as proton donors. Time dependence of the corrosion potential, potential-current relations at constant pH, and potential-current density data at constant angular velocity are detailed.

5. The difference effect and anodic behaviour of hafnium dissolving in hydrofluoric acid —

W. J. James, J. W. Johnson, and M. E. Straumanis (Corrosion Sci., 3, 273, 1963). Studies of the dissolution rate of hafnium in hydrofluoric and hydrofluoric and hydrochloric acid mixtures were made at 25°C, measurements being made before and after the application of anodic current. A positive difference effect was established. The anodic current promotes the formation of new films of unknown composition, possibly oxides or hydroxides. Noble potential values of the hafnium electrode resulted, the effect being strengthened by the addition of noble metal salts to the acid mixture. The dissolution rate data appear to agree with a direct chemical action mechanism involving molecular HF; the presence of hydrochloric acid gives a slight increase in metal dissolution due to Cl absorption at free-metal sites.

6. Effect of addition of sodium nitrate on corrosion of mild steel in fused and concentrated solution of caustic soda —

S. Rao Addanki, A. K. Lahiri and T. Banerjee (Iron and Steel, 37, No. 4, 137, 1964). Corrosion tests on mild steel plates in sodium hydroxide-sodium nitrate solutions at the temperature range from 350°—650°C. It was shown that although sodium nitrate acts as an inhibitor, it has a strong depolarizing action, especially at lower concentrations. Eighteen references.

7. Corrosion iron and its alloys in alkaline media. Protection by corrosion inhibitors in sodium hypochlorite solutions —

I Atanasiu, L. Blum-Lazar and M. Constantinescu (Revista de Chemie, **13,** 452, 1962). Effects of four inorganic and six organic inhibitors on the corrosion of six types of simple and alloyed steels in sodium hypochlorite. The detergents proved superior to inorganic inhibitors where pH remained unchanged and best results occurred at 1 to 1.5 per cent inhibitor concentration. Inhibitors weaken cathodic polarization to a limited degree.

8. Corrosion case histories (5)

(Corrosion Technology **11,** No, 7. 22, 1964)— An acid cooler consists of banks of cast iron tubes containing the acid. Cooling is achieved by spraying sea-water over the tubes. To eliminate the danger of the water and acid mixing it is necessary to protect the tubes against corrosion, particularly pitting corrosion.

9. Thermoelectric cathodic protection —

(Corrosion Technology, **11,** No. 7, 25, 1964). Introduction, principles of operation, installations using thermoelectric generators. Eight figures.

10. The influence of minor constituents in portland cement on the behaviour of galvanized steel in concrete —

C. E. Bird (Corrosion Prevention and Control, **11,** No. 7, 17, 1964). Introduction, effect of the hydroxyl ion concentration on the electrochemical potential of zinc, rate of hydrogen evolution with increased hydroxyl ion concentration, chromate and its effect on hydrogen evolution. Ten figures and two references.

11. Corrosion in gas works plant —

J. W. Chilver (Corrosion Technology, **11,** No. 8, 11, 1964). This article deals with some of the corrosion problems in conventional gas works plant. Three figures and ten references.

12. Corrosion case histories (6) —

(Corrosion Technology, **11,** No. 8, 17, 1964). A chemical plant handling materials that produce corrosive and inflammable vapours is

in the design stage. The problem is to instal a corrosion-proof electrical system.

13. **Guide to corrosion primers —**

(Corrosion Technology, **11**, No. 8, 29, 1964). Details are given of those British paints which can be described as corrosion resistant primers both one - and two - pack. The materials are generally classified according to the base or pigment which actively prevents corrosion. About 300 primers are described.

14. **Electrolytic derusting in corrosion salt solution —**

P. L. Annamalai and K. S. Rajagopalan (Corrosion Prevention and Control, **11**, No. 8, 15, 1964). Derusting is done in common salt solution at 90°C. The article to be derusted is made the cathode in the first instance for 10 minutes and subsequently the anode for 1-10 minutes passing a very heavy d.c. current of 400 asf. Three tables, two figures and twenty-one references.

15. **Minimising corrosion in uranium extraction solutions by application of anodic protection**

F. P. A. Robinson and L. Golante (Corrosion **20**, 239t, 1964). Anodic protection was applied to certain special alloys following an investigation into their anodic polarization characteristic in 0.1 per cent nitric acid + 5 per cent formic acid + 20 per cent ammonium fluoride solution saturated with sulphur dioxide; corrosion is reduced to a large extent. Five tables, seven figures and eleven references.

16. **Hydrogen absorption by and dissolution rate of low-carbon steel in sulphuric, hydrochloric, phosphoric and nitric acids —**

R. M. Hudson (Corrosion, **20**, 245t, 1964). The dissolution rate of steel in sulphuric, hydrochloric, phosphoric and nitric acids of different concentrations was studied. The amount of hydrogen introduced into the steel during dissolution in nitric acid solutions was much lower than for the other acids. Although the dissolution rates at 100°F differ between sulphuric, hydrochloric, and phosphoric acid solutions at the various concentration levels, the percentage of theoretically available hydrogen absorbed by the steel after a given weight loss did not differ significantly between these three acids. For each acid, particularly when the weight loss was low, the amount of hydrogen absorbed at a given weight loss decreased with increase in temperature.

17. **Stress corrosion cracking susceptibility of stainless steels and nickel-base alloys in polythionic acids and acid copper sulphate solution —**

C. H. Samans (Corrosion, **20**, 256t, 1964). Intergranular cracking tendencies of fourteen stainless steels and two high-nickel alloys have been evaluated by exposing numerous specimens to polythionic acid and standard acid copper sulphate solutions. Three tables and five figures.

18. **Anodic potentiostatic polarization of iron in sulphuric acid: Effect of chloride ions—**

K. Nobe and R. F. Tobias (Corrosion, **20**, 263t, 1964). Anodic polarization of iron was studied by the potentiostatic technique in both aerated and deaerated sulphuric acid solutions at pH 1, 2, and 3 at four different chloride ion concentrations (0.001-0.050M sodium chloride). The corrosion potential was independent of chloride ion concentration, but dependent on pH. The corrosion potential of iron was 30 to 40 mv more noble in aerated than in deaerated solutions. The anodic polarization of iron in the active region was not affected by chloride ions. In the passive region, however, passivity was greatly affected by the concentration of chloride ions at all the pH values studied in both aerated and deaerated solutions.

19. **Oxygen corrosion control in flood waters—**

G. B. Hatch and P. H. Ralston (Materials Protection, **3**, No. 8, 35. 1964). Influence of dissolved oxygen on the inhibitor requirements for flood water service is discussed. Applicability of the zinc glassy phosphate inhibitors for such use is considered. The accelerative action of zinc on establishing protection by the phosphate glasses is illustrated by laboratory data. Field application of zinc glassy phosphate inhibitors in several oxygen bearing flood waters is discussed.

20. **Corrosion protection for a pipe type cable system —**

J. A. Rogers (Materials Protection, **3**, No. 8, 44, 1964). Describes selection and application of a protective coating for a pipe type cable system used for underground electrical power transmission. Also describes design and installation of a cathodic protection system using rectifiers for further protection from corrosion. Discusses necessary tests to insure proper protection of the steel pipes.

21. Corrosion and temperature differential —

(Battelle Tech. Review, **13**, No. 9, 11, 1964). A thermal cell assembly is designed for studying effects of temperature differences in corrosion of metal-saline water systems.

22. Corrosion problems associated with the use of copper and alloys—

M. E. B. Smith and D. D. Stead (Australasion Corrosion Engineering, **8**, No. 9, 9, 1964). Corrosion of wrought copper and copper alloys in domestic, industrial, marine and architectural applications is discussed. Eight references.

23. The corrosion of metals and metallic compounds at high temperatures—

L. H. Keys, G. R. Wallwork and A. E. Jenkins (Australasian Corrosion Engineering, **8**, No. 9, 17, 1964). Metal oxidation, oxidation of metal carbides, the oxidation of metals at high temperatures — some of the theoretical problems like surface phenomena and metal sub-surface phenomena. Fifteen references.

24. Controlled atmosphere oxidation of steels containing nickel—

G. G. Brown and D. C. Mears (Australasian Corrosion Engineering, **8**, No. 9, 23, 1964). The oxidation of two steels containing 0.04 and 0.4 per cent nickel respectively oxidised to Wustite in controlled water vapour/hydrogen atmospheres at 900° and 1100°C. Nickel concentrates in the metal surface at 900°C but nickel rich particles form in the scale at 1100°C. The microstructural changes in the interface zone are described and the implications of these are discussed.

25. Phosphates as inhibitors in neutral solutions—

Kumari N. Shyamala, Kumari K. Venu and N. Subramanyam (Corrosion Prevention and Control **11**, No. 9, 22, 1960). Sodium phosphate and hexametaphosphate have been studied as corrosion inhibitors for the corrosion of mild steel in aqueous medium.

26. Stress corrosion cracking of high strength nickel alloys for aircraft applications—

J. F. Hildebrand (Materials Protection, **3**, No. 9, 36, 1964). Stress corrosion cracking characteristics of forged parts and billets, of AISI 4340, H 11 tool steel, and 9 and 18 per cent nickel alloy steels determined by alternate immersion tests are discussed. Effect of a molydisulphide dry film lubricant on stress corrosion cracking of AISI 4340 is described. Four tables and eight figures.

27. Organic inhibitors for carbon steel in hydrochloric acid—

R. L. Every and O. L. Riggs, Jr., (Materials Protection, **3**, 9, 46, 1964). Several cyclic type organic compounds containing nitrogen and sulphur have been screened as possible corrosion inhibitors for carbon steel in hydrochloric acid. Mixtures of these sulphur and nitrogen derivatives also have been tested as inhibitors. These data have been tabulated as a function of inhibitor concentration.

28. Sodium nitrite as a corrosion inhibitor for mild steel—

R. A. Legault and M. S. Walker (Corrosion, **20**, 282t, 1964). The effect of sodium nitrite on the corrosion rate of mild steel in chloride and sulphate media has been investigated. The results obtained support the view that passivity in these systems results from an oxide film maintained in a state of dynamic equilibrium, with protection dependent upon the rate of protective oxide film formation exceeding the rate of film deterioration. The basic function of sodium nitrite is to assist the cathodic process and thereby provide that current necessary to polarize above the critical potential for passivity. Eleven figures and thirtyfive references.

29. Study of aromatic amine inhibitors by nuclear magnetic resonance —

P. F. Cox, R. L. Every and O. L. Riggs, Jr. (Corrosion, **20**, 299t, 1964). High resolution nuclear magnetic resonance spectra have been obtained for a group of these amine bases in cyclohexane solution. There is a linear correlation between the proton resonance frequency of the amine hydrogens and the observed inhibitor characteristics of these compounds.

30. Corrosion in low-pressure boilers —

D. Kut (Corrosion Technology, **11**, No. 10, 22, 1964). Corrosion problems relating to low-pressure steam boilers operating at a maximum pressure of 200 psi, space heating boilers operating on closed water circuit and domestic hot water boilers operating on a direct tap-water circuit. Seven figures and two references.

31. Corrosion in nuclear reactors and how it is combated —

R. C. Asher (Corrosion Technology, **11**, No. 10, 29, 1964). Species of corrosion

problems, graphite moderated reactors, water moderated reactors, liquid metal-cooled reactors.

32. **Corrosion of steels and nickel alloys in superheated steam —**

W. E. Ruther and S. Greenberg (J. Electrochem. Soc., **111,** 1116, 1964). The corrosion behaviour of 18-8 stainless steels and some nickel alloys in superheated steam was found to be dependent on the surface preparation. Those treatments which left a severely cold worked surface resulted in reduced corrosion attack in subsequent exposure to steam as compared wtth annealed metal surfaces. The corrosion rate of electropolished annealed type 304 stainless steel in oxygenated steam rose rapidly as the temperature increased from 540° to 650°C. In these tests there appeared to be no effect of velocity or oxygen and hydrogen content on the corrosion rate. The nickel based alloys, particularly Inconel 625, were more corrosion resistant than type 304.

33. **Petrolatum tapes for protection of structural steel work —**

B. Perrot (Australasian Corrosion Engineering, **8,** No. 10, 15, 1964). Method of protecting steel structures against corrosion by the application of petrolatum coated tapes. The method is particularly suitable for highly corrosive areas and gives long term protection. Minimum surface preparation of the steel is required. Performance requirements of corrosion proofing systems for structural steelwork are given and causes of breakdown in conventional systems enumerated. Case histories extending over 25 years and application methods are discussed.

34. **Passivity and corrosion resistance of metal systems —**

N. D. Tomashov (Corrosion Sci., **4,** 315, 1964). The important role of principal parameters of the anodic and cathodic polarization curves in establishing the tendency to passivation of various corroding systems have been examined. Experimental data on increasing the passivity and corrosion resistance of metal by means of alloying with cathodic metals and by other methods in particular by the use of anodic protection are considered.

35. **The effect of some oxidising substances on the behaviour of aluminium alloys—**

I. G. Murgulescu, O. Radovici and S. Ciolac (Corrosion Sci., **4,** 353, 1964). By galvanostatic technique, the anodic processes on aluminium, aluminium-copper and aluminium-zinc alloys were studied under the following conditions: acid, neutral and alkaline solutions in the presence of dichromate, permanganate and nitrite ions. Anodic transients showed that the anodic process is influenced by the alloying elements, by the oxidising agent and by the pH of the solutions.

36. **Comparing the results of electrochemical corrosion testing methods with the practical performance of the materials —**

M. Pourbaix (Werkstoffe u. Korrosion, **15,** 821, 1964). Present day knowledge and experience with detailed bibliographical notes. The question as to what extent the results of electrochemical corrosion testing methods permit conclusions concerning the expected performance of the materials in practice is discussed from various aspects. After description of the test methodology applied to the determination of the stability ranges — activity, passivity, immunity — which can be defined by electrode potentials, the author deals with a number of applications such as cathodic and anodic corrosion protection, determination of pit-proneness, and stress corrosion proneness, electrokinetic tests of the effectiveness of surface treatments, protection criteria for corrosion inhibitors. Finally some applications in the field of industrial routine testing are discussed.

— V.K.V.U.