ABSTRACTS

1. **High energy: weight ratio, nickel cadmium cells—**

J. C. Duddy and A. J. Salkind (J. Electrochem. Soc., **108**, 717, 1961). A new process, adaptable to continuous methods of production, has been developed in which the active and conductive materials are dispersed in a microporous plastic structure. Cells with the high energy to weight ratio of 43 whr/kg have been constructed. Cell volumes are equal to those of the sintered plate design for equivalent capacities.

2. **Effect of sunlight on the corrosion of steel—**

L. C. Rowe (Corrosion, **17**, 267t, 1961). Steel corrodes faster when exposed to high-energy ultraviolet light than without light. A mixture of visible and infra red light apparently results in less corrosion than is caused by infra red alone

3. **Atmospheric corrosion testing of metals in Canada—**

E. V. Gibbons (Corrosion, **17**, 318t, 1961). Metals exposed included alloys of aluminium and magnesium, carbon and other steels, stainless steels, and zinc.

4. **Stress corrosion cracking: A review of current status—**

W. Lee Williams (corrosion, **17**, 340t, 1961). Introduction. stresses, types of cracking; 28 references.

5. **Corrosion of metals in tropical environments. Part 5—stainless steel—**

A. L. Alexander, C. R. Southwell and B. W. Forgeson (Corrosion, **17**, 345t, 1961). Introduction, experimental conditions, underwater and atmospheric corrosion results, conclusions; 14 references.

6. **D. S. I. R. steps up corrosion research—**

(Corrosion Prevention and Control, **8**, No. 7, 34, 1961). An account of progress in corrosion investigations at the National Chemical Laboratory, England: immersed, atmospheric, underground and bacterial corrosion.

7. **First international congress on metallic corrosion—**

T. L. Rama Char (J. Sci. and Ind. Res., **20A**, 348, 1961). A brief review of the First International Congress on Metallic Corrosion held in London during April 1961 under: mechanism of corrosion inhibition, fundamental studies, practical aspects, corrosion in atomic energy industry, metallic coatings and stress corrosion, corrosion testing procedures, paints and other topics covered in 84 papers.

8. **Some contributions of Soviet scientists to the science of corrosion and its prevention –**

I. P. Anoshchenko (J. Sci. and Ind. Res., **20A**, 359, 1961). Theory of homogeneous dissolution of metals, theory of local cells, inhibitors, null-point of metals, sea water corrosion, electroplating; 77 references.

9. **Accelerated corrosion tests for electrodeposited coatings—Techniques and limitations—**

J. A. Barbaro (Australian Corrosion Engineering, **5**, No. 7, 9, 1961). Introduction, salt spray testing, acetic acid salt spray, copper accelerated salt spray test, corrodkote accelerated test, sulphur dioxide testing, kesternich test, corrosion evaluation procedure, summary. Three tables and 17 references.

10. **The importance of specifications in corrosion control practice—**

N. S. Boas (Australian Corrosion Engineering, **5**, No. 7, 19, 1961). Introduction; basic principles, requirements and application of specifications.

11. **Water treatment for corrosion control of aluminium in low temperature nuclear reactors—**

E. W. Jackson and H. F. Molineaux (Corrosion Prevention and Control, **8**, No. 8, 36, 1961). Water treatment process. ion exchange media, operational experience.

12. **Corrosion protection by electrodeposited coatings —**

R. Weiner (Galvanotechnik, **52**, 2, 1961). It is shown how an understanding of theoretical aspects has contributed to the development of coatings of improved corrosion resistance.

13. **The atmospheric corrosion of sprayed zinc —**

C. G. Taylor (Australian Corrosion Engineering, **5**, No. 8, 9, 1961). The pore corrosion and

subsequent pore sealing of sprayed zinc which occur during the initial period of exposure to a corrosive atmosphere, largely account for the sprayed metal being comparable in protective value to more continuous coatings of zinc such as those produced by sherardizing and galvanizing. 16 references, 16 figures and 1 table.

14. **Protection against underwater corrosion and fouling**

J. C. R. Sundercombe (Australian Corrosion Engineering, **5,** No. 8, 31, 1961). Corrosion and fouling problem with particular reference to ships, methods of protection of steel structures; 4 figures and 20 references.

15. **Corrosion inhibition of aluminium-zinc alloy in hydrochloric acid solutions —**

K. G. Sheth and T. L. Rama Char (Corrosion Technology **8,** 233, 1961). Results are presented of the inhibitor efficiencies of acridine, nicotinic acid, thiourea, strychnine and quinine hydrochloride for the corrosion of aircraft aluminium-zinc alloy in hydrochloric acid solutions. The first three are the most efficient. Polarization studies with quinine hydrochloride show that anode polarization is low, whereas cathode polarization is considerable. The corrosion process with this inhibitor appears to be essentially under cathodic control. Two figures on inhibitor efficiency, anode weight loss and cathode polarization; 14 references.

16. **Automatic impressed-current, sacrificial, and combined cathodic protection systems —**

(Corrosion Technology, **8,** 250, 1961). Protection of steel propellers of ships by cathodic protection is described.

17. **Corrosion-resistance of nickel/chromium plating —**

G. N. Flint (Wiggin Nickel Alloys, No. 62, 18, 1961).

18. **Inhibition of the corrosion of pure aluminium in hydrochloric acid solutions —**

J. Sundararajan and T. L. Rama Char (J. Appl. Chem., **11,** 277, 1961). The corrosion rates and inhibitor efficiencies have been determined for 99.5 per cent aluminium in hydrochloric acid solutions, with the following inhibitors: acridine, thiourea, nicotinic acid, dextrin and tannic, acid, of which acridine is the best. Polarization studies with thiourea show that anodic polarization is negligible, whereas cathodic polarization is considerable. The corrosion process with this inhibitor appears to be essentially under cathodic control. Nine figures and 20 references.

19. **On the kinetics of iron corrosion in acids in the presence of inhibitors and oxidizing agents at higher temperatures —**

P. Anoshchenko (J. Sci. and Ind. Res., **20B,** 430, 1961): The effect of some metal cations, potasium bromide, urotropine, acrichim and their combinations on the corrosion of iron in sulphuric and hydrochloric acids in the presence of oxidizers, e. g., oxygen and trivalent iron, has been studied at 20-80°C by volume-weight methods and by plotting polarization curve. Eleven figures and 26 references.

20. **Corrosive or inhibitive character of solutions from anodic polarization measurements —**

K. S. Rajagopalan, (Miss) K. Venu and K. Balakrishnan (J. Sci. and Ind., Res. **20D,** 358, 1961. The anodic polarization method has been used to find out at what concentration of the corrosive constituent neutral and alkaline solutions containing both inhibitive and corrosive constituents become corrosive.

21. **Effect of the angle of exposure on the rate of corrosion of mild steel —**

R. S. Saxena, D. V. Bhadwar and B. Sanyal (J. Sci. and Ind. Res, **20D**, 359, 1961). The effect of angle of exposure of test panels on the corrosion rates of mild steel at Kanpur has been studied.

22. **Corrosion and electrochemical behaviour of chromium-noble metal alloys—**

N. D. Greene, C. R. Bishop and M. Stern (J. Electrochem. Soc, **108,** 836, 1961). Alloying chromium with small amounts of platinum, palladium, iridium, rhodium, ruthenium or osmium markedly improves its corrosion resistance to nonoxidizing acids such as sulphuric or hydrochloric. The presence of rhodium, palladium, or osmium has little influence on the resistance of chromium to an oxidizing acid such as nitric, while platinum, iridium, or ruthenium greatly increases corrosion rates in this medium. These phenomena can be explained in terms of the electrochemical and corrosion behaviour of the metals involved and are related to the passive and transpassive behaviour exhibited by chromium. Four tables, 3 figures and 28 references.

23. **Coatings formed on steel by cathodic protection and their evaluation by polarization measurements—**

W. J. Schwerdtfeger and R. J. Manuele (J. Res. Nat. Bur. Standards, **65C**, 171, 1961). Polarization studies were made for steel specimens in city water containing 3 per cent sodium chloride. As a result of cathodic protection — by a galvanic anode and impressed current, carbonates and silicates formed protective coatings which eventually reduced the current density required for protection from about 5 to 0.02 ma/sq. ft. The instantaneous corrosion rates on the coated specimens while without protective currents were measured by changes-in-slope (breaks) in polarization curves. Four tables, 9 figures and 13 references.

24. **The background requirements of a corrosion engineer—**

(Corrosion Engineer, **3**, No. 10, 1, 1961). An attempt has been made in this article to put the profession of corrosion engineering in perspective and to point out how industry will need to use the corrosion engineer in the future.

25. **Niobium solid electrolytic capacitors—**

N. Schwartz, M. Gresh and S. Karlik (J. Electrochem. Soc, **108**, 750, 1961). The initial properties of niobium solid electrolytic capacitors prepared under optimum conditions compare favourably with equivalent tantalum compounds. However, with the current purity of niobium powder, only units with operating voltages up to 20 volts survive a life test at 85°C.

26. **Multicoloured effects on anodized aluminium—**

A. Jogarao, B. A. Shenoi and K. S. Indira (Metal Finishing, **59**, No. 7, 42, 1961). Suitability of films for dyeing, optimum anodizing conditions, coloring with organic dyes, inorganic pigmentation, multicolor processes, superimposition and bleaching techniques, printing processes; 14 references.

27. **Eliminating the gold plating process in printed circuit boards—**

B. Warshauer (Metal Finishing **59**, No. 7, 53, 1961). Contamination, possible replacements for gold plating, cost of gold plating versus lacquer coating.

28. **Science for electroplaters 66. Nickel-hardness, tensile strength —**

L. Serota (Metal Fnishing, **59**, No. 7, 69, No. 8, 70, 1961) Hydrogen and inclusion theories; effect of bath variables, hard nickel deposits.

29. **Tin plate replaces solder coat on transistor shells —**

W. P. Alina (Products Finishing, **25**, No. 10, 36, 1961). Disadvantages of solder coating, electroplating process, advantages of tin-plated shells.

30. **Measurement of thickness of electrodeposits by the electrolytic stripping method —**

P. B. Mathur and M. L. Bhaskara Rao (Electroplating and Metal Finishing, **14**, 277, 1961). Stripping solution for cadmium over mild steel and copper-base metals: solution, experimental; 4 tables.

31. **Raising efficiency in the plating shop—**

J. Nugert (Electroplating and Metal Finishing, 14, 279, 1961). This paper describes measures which were taken to reduce plating rejects from 2.5 to 0.5 per cent. They included improved design, equipping the degreaser with a still, inserting a cyanide dip before copper plating, and neutralizing chromium plating solution.

32. **Recent developments in decorative chromium plating —**

S. W. Baier (Electroplating and Metal Finishing, **14**, 281, 330, 1961) Historical, porosity and cracking, retrograde tendencies, preliminaries to research progress mechanism of corrosion, corrosion testing, improved chromium, H.T H.R. chromium; thickness, protection, exposure tests, barrel plating; 26 references.

33. **Evaluation of fine line etching techniques for printed circuit applications —**

J. R. Sayers and J. Smit (Plating, **48**, 789, 1961). Introduction, etching technique evaluation, reproducibility of spray-etching, conclusions.

34. **Advances in nickel and chromium plating —**

T. E. Such (Corrosion Prevention and Control **8**, No. 8, 29, 1961). Introduction, corrosion-resistant nickels, chromium plating, other processes, conclusion.

35. **Electrodeposition of nickel-iron alloys from the pyrophosphate bath —**

(Miss) Vasanta Sree and T. L. Rama Char (Metal Finishing, **59**, No. 8, 49, 1961). Nickel has been codeposited with iron from the pyro-

phosphate bath. Detailed studies on alloy composition, cathode efficiency and potential have led to the optimum conditions for obtaining satisfactory alloy plates with 4-87 per cent nickel. The efficiency of cast alloy anodes is satisfactory. X-ray patterns of the deposits show the existence of f.c.c. and f c c. plus b.c c. structures. Four tables, 12 figures and 33 references.

36. **Finishing to government specifications —**

B. B. Joffe (Metal Finishing, **59,** No. 8, 61, 1961). Electrodeposited black chromium, black nickel, copper and gold ; gray plated chromium ; tin plating-electrodeposited or hot-dipped.

37. **Electrodeposition of copper-tin-alloys from the pyrophosphate bath —**

T. L. Rama Char and J. Vaid (Plating, **48,** 871, 1961). Copper has been codeposited with tin from the pyrophosphate bath. A detailed study has been made of the effect of the variables on alloy composition, cathode efficiency and cathode potential. Alloys in the range 10 to 96 per cent copper can be obtained by varying the operating conditions. Sudden phase shifts resulting from small changes of current density, at low current densities, caused sudden changes in plate composition and cathode potential The following phases were identified by x-ray studies : alpha, gamma plus eta, and eta plus tin. Five tables, 11 figures and 17 references.

38. **Iron plating —**

A. T. Clarke (Plating, **48,** 876, 1961). The purpose of this paper is to stimulate interest leading to further research and additional practical applications of iron plating. Optimum formulae and conditions are given in detail.

39. **Bibliography of metal finishing wastes, 1959 and 1960 —**

D. G. Foulke (Plating, **48,** 907, 1961). A list of 45 papers for 1959, and 42 for 1960.

40. **Electroless deposition of gold from aqueous solution on base metals of nickel and iron-nickel-cobalt alloys —**

R. F. Walton (J. Electrochem. Soc., **108,** 767, 1961). The solution for the chemical deposition of gold consists of potassium gold cyanide, citric or tartaric acid, tungstic acid, and N, N-diethyglycine sodium salt. The optimum operating conditions have been determined from the investigation of the effect of the variables.

41. **Acid gold plating —**

(Metal Industry **99,** 90, 1961). This article describes the development of an electrolyte, consisting of potassium gold cyanide and orthophosphate, which offers a high-hardness, low electrical resistance, pure gold deposit with low stress and freedom from porosity. The process is of value in the manufacture of printed circuits since the solution does not attack the adhesives used.

42. **The structure and hardness of electrodeposited chromium —**

C. P. Brittain and G. C. Smith (J. Inst. Metals, **89,** pt 2, 407, 1961). The structure of the deposits has been examined by means of optical and electron microscopy, and the hardness changes followed by microhardness measurements. It is suggested that grain size may be the main factor controlling the hardness of chromium deposits.

43. **Electrolytic polishing of refractory metals —**

F. R. Cortes (Metal Progress, **80,** No. 2, 97, 1961). This article discusses a versatile solution, composed of small amounts of sulphuric and hydrofluoric acids in methanol, which can be used to electropolish molybdenum, tungsten, tantalum and columbium.

44. **Science for electroplaters 67. Bright nickel —**

L. Serota (Metal Finishing **59,** No. 9, 70, 1961). Orientation, grain size, hardness, random orientation, cathode polarization. dislocation theory.

45. **Metal finishing technology. A Students' guide : 9 —**

A. Alexander (Metal Finishing J. **7,** 329, 1961). Crystal structure and related properties : structure of metal, crystallographic examination of deposits, effect of impurities, influence of basis metal.

46. **A look at modern barrelling practice —**

D. J. Fishlock (Electroplating, India, **3,** No. 2, 5, 1961). Barrelling media, compounds, mechanism and equipment ; special mechines ; 14 figures and 7 references.

47. **Electrodeposition of magnesium on a mercury cathode —**

A. N. Kappanna and A. Visveswara Rao (Electroplating, India, **3,** No. 2, 20, 1961). Magnesium can be deposited by the electrolysis of

magnesium chloride or sulphamate on a mercury cathode, but the current efficiency is very low not exceeding 7-8 per cent.

48. Electrodeposition of nickel-iron alloys from the pyrophosphate and sulphamate baths—

T. L. Rama Char (Electroplating, India, **3,** No. 2, 24, 1961). Nickel has been codeposited with iron from new types of plating baths, namely, pyrophosphate and sulphamate. Table gives optimum operating conditions for the production of satisfactory alloy plates from these baths. 18 references.

49. Chromic acid anodising—

B. A. Shenoi, (Miss) K. S. Indira and (Miss) K. Vijayalakshmi (Electroplating, India, **3,** No. 2, 27, 1961). This paper describes in detail the theory of anodic oxidation, anodising processes, properties of anodic coatings, bath maintenance and regeneration, and plant requirements. 37 references.

50. Electrodeposition of tin-nickel alloys from the pyrophosphate bath—

T. L. Rama Char and J. Vaid (Electroplating and Metal Finishing, **14,** 367, 1961). Tin has been codeposited with nickel from the pyrophosphate bath. Detailed studies on alloy composition, cathode efficiency and potential have led to the operating conditions for obtaining satisfactory plates with 10 to 99 per cent tin. Anode behaviour has been investigated with an alloy as well as with tin and nickel under joint and separate control. Four tables, 10 figures and 15 references.

51. Electrodeposition of tin-cobalt alloys from the pyrophosphate bath—

(Miss) Vasanta Sree and T. L. Rama Char (Metalloberflache **15,** 301, 1961). The pyrophosphate bath has been studied in detail for the electrodeposition of tin-cobalt alloys. It is possible to obtain satisfactory electroplates with 13 to 100 per cent tin in the current density range 0.35-9.8 amp/dm^2 at 35-100 per cent cathode efficiency. X-ray patterns of the deposits show the existence of b.c.t., b.c.t. plus hexagonal, hexagonal and c.p.h. structures. Thirteen figures covering alloy composition, cathode efficiency and potential; 3 tables and 14 references.

52. Plating shop layout and installation Part 1 — Layout—

C. R. Darby (Canning Journal, No. 2, 3, 1961). Introduction, automatic plant, mechanized plant, semi-automatic units, manual plant; to be continued.

53. Effect of organic compounds on metal fatigue—

(Products Finishing, **25,** No. 10, 78, 1961). Coatings of certain polar organic compounds on specimens of steel, magnesium, and copper-beryllium alloys markedly increase fatigue strength.

54. Trends in mineral research—

(Battelle Tech. Review, **10,** No. 7, 9, 1961). In the face of diminishing high-grade deposits, mineral processing research is intensifying its application of scientific principles and cooperation with other disciplines to meet coming demands for metals and minerals.

55. Applications and uses of titanium and its alloys—

R. L. Preece and K. W. J. Bowen (Metallurgical Reviews, **6,** No. 22, 241-278, 1961). Review with 223 references: introduction, aircraft industry, chemical industry, oil industry, nuclear energy, anodic polarization, platinized titanium anodes, metal finishing, pulp and textile bleaching, surgery, instrumentation and electronics, military uses, automotive applications, marine uses, miscellaneous, future trends.

56. The metallurgist in the heavy steel industry—

L. Reeve (The Metallurigist, **11,** 348, 1961). The author has concentrated in this article on the quality control and development sections of the metallurgist's work in the heavy steel industry.

57. Electrolytic coprecipitation of metal oxides—

Magneto-chemie N. V. (Brit. Pat. 864, 249). Melal oxide are coprecipitated by electrolyzing in the presence of oxygen or an oxidizing agent an alkali salt solution in which the anodes, fabricated from the metals which are to be precipitated as oxides, are separated from each other by insulating partitions, *e.g.*, glass plates, which do not entirely extend up to the cathode. The process, which can be carried out continuously is stated to offer advantages over the chemical method and mechanical mixing. The specification includes details of the procedure involved in the application of the invention to the production of a mixed oxide of Ni0 84, $Mn0_2$ 16 per cent, suitable for use as colouring oxides in enamelling.

(Continued on page 6)

Symposium on Ferro-Alloy Industry in India

The National Metallurgical Laboratory, Jamshedpur is organizing a Symposium on 'Ferro-Alloy Industry in India' during February 1962. The Symposium will broadly cover: survey of new materials, beneficiation of raw materials for indigeneous industry, evaluation of production techniques and principles, latest advances in production technology, utilization of by-products, standard specifications, present status of the industry in India and future expansion plans.

Refresher Course on Purer Metals

The Institution of Metallurgists, London held the 1961 Refresher Course on 'Purer Metals' at Llandudno during October. The following were the topics: (1) Engineering Use of Purer Metals, (2) Principles Employed in Producing Very Pure Metals, (3) Technological Advances in the Production of Purer Metals, and (4) Properties of Pure Metals. The object of these courses is to give opportunities for informal contact and exchange of views between metallurgists from all varieties of special interest and background.

International Conference on Coordination Chemistry

The Seventh International Conference on Coordination Chemistry will be held at Stockholm and Uppsala, Sweden from June 25 to 29, 1962. It has been organized by the Swedish Chemical Society with the sponsorship of the Swedish Government and the International Union of Pure and Applied Chemistry. Attendance is by invitation only. Papers will be presented under 6 sessions: (1) the chemical bond in coordination compounds, (2) coordination in fused salts, (3) biochemical applications, (4) isopoly and heteropolyions, (5) donor-acceptor reactions, and (6) general. Plenary lectures will be delivered by specialists from several countries.

—T.L.R.

(Concluded from page 22)

58. **Anodic polarization of stainless steel in chloride solutions—**

G. M. Schmid and N. Hackerman (J. Electrochem Soc, **108**, 741, 1961). The existence of maxima in the potential-time curve for stainless steel in potassium chloride was verified, and the time for the potential to decay to +0.5 v vs SCE was measured. Polarization data support the view that the effect of the chloride ion can be due to sorption phenomena, without assuming an oxide film.

59. **Lead dioxide anode in the preparation of perchlorates—**

K. C. Narasimhan, S. Sundararajan and H. V. K. Udupa (J. Electrochem. Soc., **108**, 798, 1961). The influence of the variables on the current efficiency of perchlorate formation from chlorate was studied using as anodes lead dioxide deposited on graphite or carbon. Addition of fluoride together with sulphuric acid has the maximum effect on the efficiency under acidic conditions. Eight tables, 2 figures and 26 references.

60. **Electrical properties and kinetics of electrode reactions—**

R. J. Brodd (J. Res. Nat. Bur. Standards, **65A**, 275, 1961). A common basis for investigations of the properties of electrode reactions is provided. The basic equations of electrostatics and electrodynamics and the assumption that electrode reactions are relaxation processes, are used to develop the equations for the electrical behaviour of electrode systems. Thus electrode reaction processes are characterized as two states separated by an energy barrier.

—T. L. R.