ABSTRACT

METAL FINISHING

Volume 78, No. 10 October 1980: *Wastewater, and Hazardous Solid Waste Disposal in the Aluminium Product Industry : M. Marino.*

The aluminum products industry is and will continue to be affected by everchanging wastewater discharge and hazardous waste disposal regulations. Therefore, some degree of wastewater treatment prior to discharge to either a running body of water or a publically owned treatement works is likely, requiring capital and operating expense and floor space planning considerations. Solid waste, which in the past has been acceptable to sanitary landfills, soon will require classification as either hazardous or non-hazardous before the ultimate disposal method can be determined. As a result, haulage and disposal costs can be expected to escalate significantly in the near future.

Paint Booth Sludge Handling – A Comparison : Norman R. Roobal.

One of the most important findings of this study was that all paint shops periodically experienced similar sludge handling problems. The ability to consistently ditackify paint is most difficult to accomplish. Sludge does stick to equipment and surfaces, and periodic cleaning is required in all systems.

Dissolved or dispersed air flotation is a method of removing very small particles from process water. The machines are multi-celled units with many moving parts and high power usage. The main disadvantage is the particles removed are in the form of a wet foam that must be dewatered further before being disposed of.

Flat bed filters have the advantage of producing a much drier sludge than air flotation, especially when vacuum is used to assist drainage. All flat bed filters require the use of disposable filter media, which adds to the operating expense of the system. The rotary strainer is a very simple and durable method of removing suspended solids. The disadvantages are that the sludge removed is fairly wet and that particles smaller than the screen openings will not be removed. The advantages are that it can remove larger pieces of debris. it is totally self-cleaning and many of its features allow easy maintenance.

The degree to which any equipment or system is successful depends heavily on the amount of dedication of the maintenance personnel involved. There is no single piece of removal equipment that is by itself consistently better than any others.

Electrodeposition of Bismuth-Thallium Alloys and their X-Ray Structure : Y. N. Sadana and W. G. Kerr

The Future of Cadmium

Interest in cadmium was high at AES's SUR/FIN'80 in Milwaukee. About 200 eager conventioneers attended the panel discussion titled, "Cadmium Faces the Future". They may have come with healthy skepticism, but most left with a feeling that the decade of the 80's at least will witness a solution of environmental and supply problems.

Applying Organic Coatings : Joseph E. Ziegeweid

Tools of the Trade ; Electroposition of Zinc from a Cyanide-Free, Near-Neutral Electrolyte : Malathy Pushpavanam and B. A Shenoi.

A near neutral zinc electrolyte has been developed which is capable of producing bright deposits without expensive waste treatment costs. The insensitivity of the appearance of the deposit to the operating parameters, the good deposition rate and the low cost of the addition agents, should make the process attractive for commercial use. The

optimal composition of the electrolyte was found to be :

Zinc (sulfate or chloride)	20 g/L
Potassium chloride	100 g/L
Boric acid	30 g/L
Gluconic acid (sodium salt) pH : 6	100 g/L
Temperature . 25-35°C	
Current density	2.5 A/dm²
Polyethylene glycohol	2 ml/L
Anisaldehyde	2 ml/L

Volume 78, No. 11 November 1980

Hot Dip Aluminium Coating of Steel : V. Sivan

Surface Active Agents : Henry a Goldsmith

Applications and Developments in nickel Electroforming in Toolmaking : W R Wearmouth

Electroforming is becoming increasingly important in the production of tools. because of shortage of skilled toolmakers and the elimation of hand finishing. Applications are described which illustrate some of the advantages of electroforming. Also, new process developments are described which increase the competitiveness of electroforming compared with conventional die sinking techniques.

Applying Organic Coatings : Joseph E. Ziegeweid

Electrocodepositied Composites of Graphite, molybrdenum Disulfide and Tungsten Disulfide with Copper for Tribological Applications : Mohamad Ghouse, M. Viswanathan, and E G Ramachandran

Composites of graphite, MoS_2 and WS_2 with copper were prepared by electrocodeposition, using the conventional technique as well as the technique of sediment codeposition recently developed by the authors[1] and described elsewhere[2]. While the composition of the coatings was determined by chemical analysis, other properties such as porosity and distribution of the second phase in the matrix were examined by both optical as well as scanning electronmicroscopy, and the hardness of the coating studied by a low load hardness tester.

The results of the investigation reveal that, while the SCD technique yields generally superior composite coatings, a greater incorporation of graphite as compared to MoS_2 or WS_2, is observed for similar conditions of electrocodeposition.

Volume 78, No. 12 Decemcer 1980

The Effect of Contamination Anions on the Electrocoat Process on Aluminium : Kenneth E. Jasenof

Anionic contamination can have an effect on the degree of oxide formation during electrodeposition. The chloride ion has the most drastic effects while the sulphate and nitrate ions have little effect. The chromate ion apparently causes more metal dissolution by chemical means.

The corrosion resistance is affected the most by chloride ions, while sulfate, nitrate, chromate or the amount of oxide formed had little or no effect.

Hard Facts : About hard chrome : Clarence H. Peger— 1. Hard Chrome plating by Voltage.

Studies on Electrodeposition from Modified Castor Alkyd Resin System: S. Guruswamy, P Jayakrishnan, V. Yegnaaman, N. Shanmugam and R. Rajagopal. C. E. C. R. I., Karaikudi.

Efforts were made to develop suitable vehicles for electrodeposition of coatings based on vegetable oils. The authors describe the preparation of a modified alkyd resin based on castor oil. The aqueous bath of this resin is subjected to electrodeposition experiments to determine the effects of resin concentration, deposition voltage and bath temperature on current-time behaviour. The cured electrodeposited film was subjected to conical mandrel bend and scratch tests to assess physical properties such as flexibility and hardness.

Addition Agent for High-Throw Tin Fluoborate Plating Baths : Art Wasserman

Applying Organic Coatings : Joseph E. Ziegeweid. Tools of the Trade.

Volume 79, No. 1 January 1981

Microcracked Chromium Plating : Dimiter Christov Russev and stefan Jordanov Karaivanov.

A new brightener for watts type nickel electroplating baths is offered. The Compound, which is a result of the reaction between the hydrazide of pyridine-4-carboxylic acid and acrylonitrile in

ethanol, causes high brightness and high internal stress in nickel deposjts. The relationship between the above mentioned qualities of the deposit and plating variables are studied, and it is shown that, under certain conditions, a fully bright deposit can be obtained. The internal stress of such deposits depends on its thickness and is almost unaffected by the other conditions. Microcracked coverage can be achieved when chromium is plated from a bath over a nickel layer with an internal stress about 39 kplmm^2, obtained from an electrolyte with the new brighter.

Effects of Waterborne Paints on Wastewater Treatment : *Dr, Norman R. Roobol and Joseph p. Gibson*

The use of waterborne coatings was shown to have no major effects on wastewater treatment when spraybooth water was a component in wastewater feed. Compared to organic solvent paints however, waterbornes may require slightly increased amounts of aluminium sulfate to flocculate oils and suspended solids in wastewater.

Hard Facts About Hard Chrome : *Clarence H. Peger* II-Temparature Considerations in Hard and Bright Chrome Plating.

Applying Organic Coatings : *Joseph E-Ziegeweid* Tools of the Trade.

Plating on Difficult-to-Plate Metals : *Report of an American Electroplaters' Society Symposium* : *D. S. Lashmore*.

Volume 79, No. 3, March 1981 :

Chemical Etching Versus Plasma Etching in Electroplating ABS Resin Surface : *C. A. Villamizar, J. Rojas and P. Frias.*

An investigation was made to determine differences in adhesion of copper to AES surfaces etched by two methods : (1) a chemical system formed by chromic acid solutions and (2) a plasma system formed by an oxyzen stream that passes through a radio-frequency coil. ABS specimens, after being etched, were acid copper plated. Peel strength and cyclic thermal tests were performed to determine adhension properties of the metal to the plastic substrate. Scanning election microscopy (SEM) was used to study the surface characteristics of the plastic specimens after etching.

Micrographs showed a selective attack on the chemically etched samples etched with oxygen plasma. Themo-gravimetric analysis showed a great difference in heat stability between the samples treated by the two etching processes.

The results show that mechanical interlocking is the predominant controlling factor in metal-to-plastic adhesion of the samples treated with chemical etchant. In plasma etching, however, the strength of the surface layer, produced by cross-linking or elimination of weak boundary layers, and wetability, are the important factors in controlling the adhesion of the copper to samples etched with oxygen plasma.

Formation of Blister Defects in Anodic Electrodeposited Resin Films on Aluminum : Bernard R. Baker.

Anodic electrodeposition of resin films on aluminum sometimes results in a highly blistered film. The principal cause of these blisters is shown to be residual phosphate ion from the metal pretreatment. Blistering can be minimized even with phosphate pretreatments by rigid electrodeposition bath control the precise cause of bath contamination is not known but may be due to aluminum ions injected into the bath with continued use.

Hard Facts About Hard Chrome : *Clarence H. Peger* IV-Stopoff-A better Way

Pollution Abatement, Materials Conservation and Recovery : *Part III-Methods of Effluent and Waste Treatment-Contimuous* : *F. A. Steward and Leslie E. Lancy.*

Applying Organie Coatings : *Joseph J. Ziegeweid* Tools of the Trade.

The Origins and Minimization of Detects in Sputtered Thin Films : *Ronald S, Nowicki.*

Due to time limitations and the improbality of investigating the large matrix of deposition parameters available. sputtered thin films tend to exhibit a wide variety of potential defects typical on non-optimization. For example, the thickness-limiting high intrinsic stress found in sputtered

refractory metal films is a frequently-enccuntered problem. Another problem of ten seen is the premature failure of passivating, or abrasive-resistant films, e. g., aluminium oxide. Additionally, so-called thin film "barrier" metalizations are sometimes seen to fail for no apparent reason after performing well previously. This study will discuss specific examples of the above problems and present workable solutions. The use of thin film analytical techniques, e.g., Auger and ESCA microanalysis, to achieve these solutions will be stressed.

GALVANOTECHNIK

Volume 71, No. 9. September 1980

Wisker Formation in Tin, Tin-lead Alloys, Silver and Gold : J. L. Jostan. 946-955

After some introductory and general comments on the causes, nature and practical effect of whisker formation, this literature study deals with the occurrence of whiskers in tin, as well as lead alloys, silver and gold. Measures for the suppression of whisker formation, particularly by the use of tin-lead alloys which are on the other hand comparatively safe, to avoid the danger of short circuits as a result of whisker fo mation are described.

Recent Developments in the Rapid Deposition of Noble Metals in Continuous Strip Plating Plants : R. Duva.

Holographic Testing of Mettalic Coatings (Part 2) : W. Neumann, K. Breuer

In the present continuation of the article which was commenced in the issue 4/1979, pp 339-344 of this Journal, the results of the application of the double illumination method of holographic interferometry needed for object deformation as a result of torsion vacuum loading and temperature change on the limits of defect demonstration was studied. A thermal object deformation undoubtedly gives the best results ; adhesion defects of up to at least 3 diameter for nickel deposits of 0,01 mm, 0,02 and 0,03 mm could be demonstrated.

Defects of Electroplated Components (9. Part) : F. W. Hirth, H. Speckhardt, K. Stallmann.

A series of articles on defects which have occurred in practice. The examples deal with faulty electroplated articles. The causes of the defects, their investigation, and the results obtained are described.

Volume 71, No. 10 October 1981

Electroplating and the Environment : R. Kammel H. W. Lieber

The concepts of elimination, reduction and prevention technology relate to a development which must be carried out under the presentday twin pressures of public opinion and an abundance of legal regulations. In recent years it has become increasingly evident that the need for meeting the expense of constantly tightened-up rules for the protection of the environment has in the course of time become an unbearably high economic burden. These cost avalanches can only be avoided by the use of processes which largely prevent contamination of the environment.

Surface Treatment and Hydrogen Embrittlement : J. Weber

The problem of hydrogen embrittlement is comprehensively dealt with. Essential features are the mechanism of absorption of hydrogen, the steel material, the relation between hydrogen embrittlement and surface treatment, as well as measures for the prevention and elimination of hydrogen embrittlement.

The Chemical Deposition of Dispersion Coatings : The Incorporation Molybdenum Disulphide : G Gawrilov, D. Butschkov.

The demand for surfaces having good abrasion resistance provides a basis for the further development of dispersion coatings.

The possibility of depositing dispersion coatings of the nickel phosphate type matrix/molybdenum disulphide by means of chemical nickel plating is described. Molybdenum disulphide contents of up to 2 per cent by weight in the coating were stipulated. The stabilizing effect of molybdenum disulphide in acid solutions for chemical nickel plating is demonstrated.

Measurement and Control Technique in Waste Water Treatment and Material Recovery :

G. Wilholm

Water treatment, effluent handling, and material recovery require measuring apparatus for the checking of the continuous reactions according to the required degree of automation. The fundamental principles of such apparatus for pH value measurement, following of Redox Reactions, ion sensitive measurements, determination of electrical conductivity, and photometric concentration measurement are described. Automatic balancing and control are considered.

Defects on Electroplated Components (10 part) :

F. W. Hirth/H. Speckhardt/K. Stallmann

A series of articles on defects which have occured in practice. The examples deal with faulty electroplated articles. The causes of the defects, their investigation, and the results obtained are described.

Volume 71, No. 11 November 1980 :

The Practice of Gold alloy Deposition : W. Fluhman

From practical experience of the deposition of gold alloys, it is seen that no significant resolution of problems which may occur is possible without taking the metallographic aspects into account. The author describes the step-by-step development of modern know-how over the past hundred years.

The possible structure of Different Chromate Films on Electrolytically Deposited Zinc Coatings : Bishop/Burdt/Romer

The chemical structure of yellow and blue chromated films and the like from solutions on an pure Cr (III) basis was studied by means of Auger Electron Spectroscopy and Electron Spectroscopy for chemical analysis (photo-electron Spectroscopy). None of the results obtained contradicts the hypothesis that chromate films consists of Cr (III)-olation polymers and various oxo-ions, and that these polymers can function as ion exchangers, especially flouride and hydroxyl ions against chromate and bichromate ions.

The Ductility of Electroplated and Chemically Deposited Coatings : W. Riedel

After a consideration of the definition and nature of ductility, together with the factors which determine, experimental investigations on chemically deposited copper coatings are described. Three dimensional lattice defects, too high micro inetrnal stresses and the presence of one of the structures which influence plastic deformability are responsible for the brittleness of these coatings.

Water treatment : Information for Management and Operating Roles in the Fields of aactory, Sanitary, Heating and Refrigeration Technology (part-I) : S. Nietz.

This seven part series starts with a comprehensive review, and also formulates the questions as to why water treatment is required and when no water treatment is necessary. The description of treatment process commences with a discussion on phosphate-stabilization and softening.

Defects on Electroplated Components (10 Part) : E. W. Hirth/H. Speckhardt/K. Stallman

A series of articles on defects which have occured in practice. The examples deal with faulty electroplated articles. The causes of the defects, their investigation, and the results obtained are described.

Volume 71, No. 12 December 1980

Corrosion of Titanium in Electroplating Practice : K. H Tostmann

The chemical corrosion behaviour of titanium, especially in chloride-containing solutions, as well as measures for the protection of titanium materials, are described Titanium alloys with at least 0.15 percent palldium contents are more resistant to corrosion than pure titanium.

Water treatment : Information for Management and Operating Roles in the Fields of Factory, Sanitary, Heating and Refrigeration Technolopy (part II) : S. Nietz

As further treatment process, partial carbonate removal by means of acids, total carbonate removal,

partial desalination by reverse osmosis, softening plus reverse osmosis, total desalination with ion exchangers and total desalination with reverse osmosis plus mixed bed ion exchange, are described.

Electrolytic Deposition of Satin Nickel Coatings ; B. Pantschev

The results of investigations carried out with the object of developing a new process for the deposition of satin nickel coatings are reported ; the solution employed in this new process differs in principle from all hitherto known techniques. The compositions of the electrolyte and the operating conditions are given ; the relationship between the thickness of the copper and nickel coatings employed in the system and initial surface finish of the most substrate, as well as the corrosion resistance and the important mechanical properties are described.

Volume 72, No. 1, January 1981

Investigations on the Electrodeposition of Metals Under Weightless Conditions : J. Ehrhardt

As part of the TEXUS! (Technological Experiments under weightless Conditions) Rocket programme, a project was included to establish whether the electrodeposition of a nickel dispersion coating is fundamentally possible under zero gravity conditions. The conception of this experiment, its execution, and the evaluation of the research data are described ; the summareised results are considered.

Deposition of Corrosion Resisting Chromium Coatings : W. Anke

Increasing requirements for the corrosion resistance of hard chromium deposits have led to the development of microcracked chromium coatings and the use of modern multilayer hard chromium systems. The author provides a summary of these developments. The growing interest in chemical nickel/hard chromium systems is referred to.

Water Treatment : Information for Mangement and Operating roles in the fields of factory, heating, and refrigeration technology (part III) : S. Nietz.

This part describes the treatment process installed in the office and works buildings of IBM, and enumerates the fundamental operating conditions for consumption systems.

Volume 72, No. 2 February 1981

Chromating of Zinc :
K. R. Romer, H. Schmidt, N. Fuchs

Broad picture of present status of the chromating technology. Characteristics and applications are described as well as the influence of the various process parameters on the properties of the chromate coatings. Short accounts of the control of the processing solution and the testing of the films round off the article.

Chemical Deburring and Brightening of Ferrous Materials : L. Laser, W. Altgeld

The examples given show that nowdays racked and bulkplated articles can be chemically deburred and electroplated in automatic plants with reproducible results. The process have established themselves in practice.

Method and Process Parameters for Increasing the Quality of Electrodeposited Zinc Coatings and Chromate films : K. Beyer

The requirements of electrodeposited zinc coatings with respect to optimum corrosion are described, with particular reference to the technical process parameters of the various methods of chromating, the control and supervision of which is essential for obtaining qualitatively perfect chromated coatings.

Bright Zinc Plating in Weak Acid Electrolytes : J, Harsanyi, E. Grunwald, C. Varhelyi

The electrodeposition of zinc from weak acid electrolytes in barrel plating plants was investigated. Covering power, the influences of the pH, temperature and metal throwing power, electrolyte contaminents and their effects' and also defects in the zinc coating are dealt with. The corrosion behaviour of zinc deposits is briefly considered.

Volume 72, No. 3 March 1981

Anodic Oxidation of Aluminium and Aluminium Alloys : W Gaiber

The anodic oxidation of aluminium can no longer be overlooked in modern technology. This survey of

anodic oxidation deals with the formation and types of coatings, GS anodizing and the characteristics of the films obtained, as well as special anodizing methods, anodizing plants and the economic importance of this surface finishing technique.

Compact Technologies and Compact Construction of Automatic Electroplating Plants : W. Burkhardt

The comparsion of conventional and compact technologies based on electroplating with zinc as an example shows the possible reduction in the number of process stages. The technical requirements and advantages of the multiple use of spray rinsing stages in the above mentioned technolcgical cycle are described.

Volume 72 No. 4, April 1981

Coating Thickness Distribution and Coating Thickness Variation in the Electroplating of Small Components : D. Wolfhard

In finishing, the object is to deposit coatings which have the most uniform coating thickness distribution and low variations in coating thickness, taking into account the need to produce the anticipated deposit thickness. The problem posed was investigated, as an example on small shafts having different shaft shoulders, and on square flat components with different size holes, which together made up an assembly. The results make it evident that uniform coating thickness distribution on mating surfaces are not obtained by any individual measures, but by the simultaneous employment of technical design and production procedures.

Direct Potentiometric Concentration Measurements with Ion-Selective Electrodes : F. Oehme

After a short introduction on the definition and methods of direct potentiometry, important problems are chosen and possible ways of solving them shown. The examples of applications include the determination of the free acid in phosphating solutions, the analysis of pickles for stainless steels, the determination of silicofluoride in chromium electrolytes, the determination of nitrate in the presence of chlorate in phosphating solutions, and the estimation of the silver content of silver cyanide electrolytes.

METALS AUSTRALASIA

Volume 12, No. 7, August 1980 :

Activated Carbon Adsorption for Solvent Recovery in Vapour Degreasing :

Volume 12, No. 8, September 1980 :

Practical Aspects of Fluidised Bed Heat Treatment Furnaces : J. A. Martyn

This paper outlines broadly the mode of operation of fluidised bad furnaces currently in use in the field of heat treatment cycles that can be carried out in these units are discussed.

Better Quenching for Better Quality : R. H. Atkin A. J. Kemp, D. *G. Paddle*

Applications of Hard Chromium Plating: D J. Reeve

Volume 13, No 2, March 1981

Pressed Metal Fasteners : Ruby Novotny

Screw Fasteners and Swage Lock Systems : L. W. Butler & D. *R. Eldridge*

Potential Use of Brisbane Sludges As Fertilizer : P. J. Makinnon

The application of digested sluge to agricultural land has been recognised as a desirable means, both environmentally and economically, of sludge disposal. In addition to being inexpensive, land application recycles nutrients essential for plant growth and provides organic matter important for soil structure. However, an excess of certain heavy metals and nutrients is known to be toxic to crops. This paper looks at the heavy metals removed in Brisbane's two largest waste water treatment plants and makes a preliminary assessment if the possibility of utilizing the sludge as a fertilizer.

Volume 13 No. 3 April 1981

Plasmared—A New Technology for the Manufacture of Sponge Iron : Sven Santen

New Roles for Tin in Powder Metallurgy : K. W. Sweatman.

Geothermal Corrosion : T. Marshall

The mechanisms of many corrosion phenomena in a geothermal environment are not fully known, and engineering practice is based to a large extent on empirical knowledge. Accordingly, this paper presents a practical viewpoint of corrosion in geothermal plant.

Mechanical Zincs : M. S. Pennisi

Volume 13 No. 4, May 1981

The Application of Grid Strain Analysis Within G. M.—H. Press Shops : Trevor J. Nihill

Application of Aluminium Sheet Products in the Automotive Industry : Ian Pocock

The Present State of High-Strength Steel Sheets for Automobiles and their Application in the Japanese Automotive Industry : Hiroshi Takechi

Semi-Automatic aud Automatic Belt Polishing on Brass Faucets and Tap Bodies prior to Plating : K. H. Eder

PLATINUM METALS REVIEW

Volume 24 No. 4 October 1980

The Catalytic Engine—Platinum Improves Economy and Reduces Pollutants from A Range of Fuels : R. H. Thring

The concept of an internal combustion engine where the oxidation of the fuel is brought about with the aid of a catalyst offers the advantages of a stratified charge engine without the disadvantages. It should give good economy and low emissions of exhaust pollutants. Several such catalytic engines have been built and run, and test results are promising ; in particular, one engine shows better fuel economy than the conventional petrol engine coupled with lower hydrocarbon emissions than either petrol or diesel engines.

International Congress on Catalysis : New Horizons in Catalysis by the Platinum Metals

At four yearly intervals the International Congres on Catalysis provides an opportunity to identify the major areas of growth and importance in catalysis, particularly where the noble metals are involved. This articles reviews some of the many papers on catalysis by the platinum metals that were presented at the latest congress.

Productivity in Platinum Mining . A Continuing Programme of Successful Development in underground Mechanisation.

Notable progress has been made by Rustenburg Platinum Mines in their efforts to increase mechanisation and to improve efficiency during mining operations ; a brief account of some aspects of this work is presented here. It is anticipated confidently that such means will help them to maintain supplies of the platinum group metals at prices which both encourage demand and ensure supply.

Catalystic Aspects of Some Phosphine Complexes of the Platinum Metals : Papers at the Recent North American Symposium: Prof. F. R. Haretly

The 1980 Biennial Symposium jointly organised by the Inorganic Divisions of the Canadian Institute of Chemistry and the American Chemical Society, held in Guelph, Ontario, from the 5th to 7th June, was entitled "Catalytic Aspects of Metal Phosphine Complexes". This article concentrates on the contributions presented there that were particularly concerned with the platinum group metals.

Ancient platinum Technology in South America : Its use by the Indian in Pre-Hispanic Times : David A. Scott and Warwick Bray.

The early inhabitants of South America had recognised platinum and had used it for making ornaments well before the Spanish Conquest. Their techniques and ability in metal working are reviewed, based upon archaeological evidence and modern metallographic examination.

Volume 25, No. 1, January 1981

Thick Film Platinum Resistance Temperature Detectors: The Development and Manufacture of Advanced Types for industrial and Domestic Applications: *W. D. J. Evans.*

The development of a range of thick film platinum resistance temperature detectors is described and the method of manufacture of a cylindrical version by a highly automated route is outlined. These novel detectors comprise a film of platinum bounded to an inert ceramic substrate and protected from the environment by a ceramic glaze and the advanced version of this series show stability in sealed probes to maximum rated temparatures as well as improved thermal stability relative to previous versions.

The Generation of Pure Hydrogen for Industrial Applications: On-Site Production uses Siver-Palladium Membranes

Control of Nitrogen Oxide Emissions from Automobile Engines: *The Development Rhodium/ Platinum Three-Way Catalyst Systems*: *B. Harrison, B. J. Cooper and A. J J. Wilkins.*

Regulations requiring strict control of nitrogen oxide emissions from automobiles come into force in 1981 in the United States. This has necessiated the development of new catalyst systems that are capable of controlling nitrogen oxide as well as hydrocarbon and carbon moroxide emission from spark ignition engines. These devices are known as three-way catalysts. Johnson Motthey have developed catalyst systems based upon platinum and rhodium to meet the requirements and these have been certified for use on 1981 model year vehicles by a number of automobile manufacturers.

The Resistance to Fatigue Crack Growth of the Platinum Metals: *They May Display the Highest Resistance of all Metallic Materials*: *Professor Markus O. Speidel.*

The effect of the cyclic stress intensity on the growth rates of fatigue cracks in the platinum metals in air can be predicted on the basis of established correlation equations. These suggest an inverse relationship between the growth rate of fatigue cracks in a material and its elastic modulus, and this has been experimentally confirmed for platinum and palladium and for a 30 per cent rhodium-platinum alloy. It may therefore be expected that ruthenium and rhodium have a higher resistance to fatigue crack growth than most other metals. Osmium and iridium may have absolutely the highest resistance to fatigue crack growth of all metallic materials. The effect of an evacuated test environment is also considered,

Volume 25, No. 2 April 1981

Liquid Fuels from Coal: Departments in the use of Ruthenium Catalysts for the Fischer-Tropsch Reaction: R. C. Everson and D. T. Thompson.

It is now possible by selecting appropriate reaction conditions to use ruthenium on alumina catalysts to produce economically viable ranges of gasoline and diesel fractions from the synthesis gas produced by coal gasifaction. Recent work has shown that simultaneous use of ruthenium with an intermediate porezeolite produces high octane gasoline. The activity and selectivity achievable with ruthenium are compared and contrasted with results from systems based on iron and cobalt catalysts which have already achieved commercial significance.

Towards the Absolute Zero: *The use of Conventional and self-calibrating Rhodium-Iron Resistance Thermometers*: *R. L. Rusby.*

The wide range of use of the platinum resistance thermometer, roughly 10 to 1000 K, is by no means enough to satisfy all demands for temprature standards. Ten years ago thermometers modelled on the capsule-type platinum thermometer but using an alloy of rhodium with 0.5 per cent iron were developed at the National Physical Laboratory specifically to provide standards for lower temperatures, and these are now widely used down to 0.5K. In a recent joint experiment between the U. S. National Bureau of Standards and N. P. L., rhodium-iron has been used down to 0.01 K by coupling a small sample of the alloy to a resistive SQUID. Such a device is capable of measuring accurately voltages of less than one nanovolt, and also of measuring the noise voltage in the resistor. Since the latter is dependent on the absolute temperature

in a way that could be calcuclated, the device was able to provide its own calibration.

A Chemist's View of the Platinum Met Is : Correlations between their Properties and their Fundamental Atomic Parameters : Brain F. G Johuson.

Platinum Anti-Cancer Drugs : A Discussion on the Mechanism of Action.

The Pallaphode Electrode System : A Robust Long-Life Sensor for Measuring the Hydrogen ion concentration in Many Media :

An Early Industrial Application for Malleable Platinum : Its Use in Flintilock Firearms : Ian E. Cottington.

AUSTRALASIAN CORROSION ENGINEERING

Volume 24, Nos. 7/8, July/August, 1980

Coal-An Alternative to Oil : Professor Dr Horst Pommer.

Volume 24, Nos. 9/10, September/October, 1980

Calibration and Standards Programs for Ultrasonic NDT : H E. Van Valkeuburg.

The Reduction aud Display of Ultrasonic Data : A Mass Data Channel : D. S. Bloser

Volume 24, Nos. 11/12, Nov./Dec , 1980

Fibreoptics for Industry : A. E. Hanwell.
Focusing on Penetrant Inspection Variables : R. C. Booth.

High Speed Probe Drive System for Eddy Current Examinations : N Nielsen.

COPPER TOPICS

Volume 6, No. 1, March 1981

Quality of Continuous Copper Rod Made by Small SCR System Yea-Yang Su.

Copper-Nickel Cage to Help Fish Farmars Lure Big Markets.

AUSTRALIAN CHEMICAL ENGINEERING

Volume 21, Nos. 9/10, September/October, 1980

Rubber as a Material for the Prevention of Corrosion : J. Boehnert.

Electrostatic Penetrant Inspection : G. E. Brown

Volume 21, Nos. 11/12, Nov. Dec., 1980

Modern Aspects of the Application of Film-Fluorometallic Screen Systems in the Field of NDT . E. Borcke.

Do-It-Yourself Ultrasonic Testing : G. L. Ferguson.

Volume 22, Nos 1/2, January/February, 1981

Calibration and Standards Programs for Ultrasonic NDT : H. E. Van Valkenburg.

Farrous Alloys For Corrosion, Abrasion of Heat-Resistant Castings : Sidney M Renof.

Volume 22, No.3, March, 1911

Four New Special Stainless Steels Ultrasonic Flaw Detection Characterisation—An Australian View : D. C. Hollamby.

MINERALS SCIENCE AND ENGINEERING

Volume 12, No. 3, July 1980

Deep Fluid Penetration and Ore Depositiou : R W. Hutchinson, W. S. Fyfe and R. Kerrich.

Direct observations on continental geothermal areas and sea-floor hyd othermal systems leave no room for doubt that many ore deposits are products of thermally driven fluid convection. Heat-flow studies show the types of patterns of such systems that may be looked for in mineral exploration. The flow velocity aud discnarge characteristics of a system may be related to the form of a deposit ranging from a massive ore body to a chemically enriched sediment or to a wide dispersion of values. It is now considered that more than one quarter of the Earth's present surface is involved in geothermal convective systems, which represent a major cooling mechanism for the Earth. It is also becoming

apparent that in addition to the abundant and mobile base metals, elements such as tin, chromium, lead, nickel, tungsten, platinum, and palladium are transported through fracture systems and vented into the ocean-floor environment by high temperature brines under conditions of low redox potential.

Theory and Practice of Copper Sulphide Leaching in Dumps and In-Situ : L. E. Murr.

The paper presents a critical review of the leaching of copper-bearing ore and waste in dumps, heaps, and in-situ. Beginning with an historical perspective that traces the development of leaching in antiquity to large commercial processes around the world, the review proceeds to deal with the phenomenological aspects of dump and in-situ leaching. The leaching process is detailed in terms of reaction chemistry, and the role of bacteria in catalysing these reactions is also treated in considerable detail. Reactions involving precipitation and the role of precipitates are described, and the synergism of physics, chemistry, and biology in copper leaching or copper hydrometallurgy is illustrated along with the complex dump ecosystem involving microorganisms and their interactionwith the mineral regimes in geomicrobiological and biohydrometallurgical phenomena. The applications and implications of modelling and scaling in leaching are described and recommendations for optimization are discussed in connexion with aspects of practical dump leaching concerning solution chemistry and the recovery of copper in solution by cementation. The review summarizes the state-of-the-art of copper suiphide leaching from ore and waste, and provides a framework for thedesign and optimization of leaching regimes based upon conclusions that can be derived from research to date.

Although considerable interest in the hydrometallurgical recovery of copper from copper sulphides and mixed oxide-sulphide ore deposits and low-grade waste dump materials, as well as in-situ or in-place ventures, has intensified over the past decade in response to clean-air requirments and related environmental considerations as well as a growing interest in non-smelting recovery technologies, a clear picture of the interdependence of these many facets of the leaching process has been lacking. The review provides such perspective, in an overview of the complex synergism ; and presents some new, graphic, observations of the sometimes subtle phenomena involved in the copper leaching process.

BATTERY

No. 11 : Batteries Face A New Dawn : Albert R Cook.

No. 12 : Portable Power-Big AC from Small DC.

No. 13 : Lead Battery Roundup : M. G. Mayer.

Battery Scrap Processing by Wet - Mechanical Methods : Akbar Farahmand.

MOLYBDENUM MOSAIC

Volume 4, No. 3 :

The Dual Phase Steels : Physical Metallurgy of the Dual Phase Steels : A P. Coldren and G. T. Eldis.

Commercial Develpment of DUAL PHASE Steels in the United States : R. M. Buck.

Commercial Development of DUAL PHASE Steels in Europe : G. Tither and P. Boussel.

Commercial Development of DUAL PHASE Steels in Japal : T. Chihara

GALVANIZING

Jan-March 1981 :

Hct dip galvanized transmission line tower-30 years of exposure : R. Westerlund.

Recovery of zinc from galvanizers' ash : J. Culen.

Effect of silicon on galvanizing.

No. 26 : Control of pickling acids

Painting galvanized steel.

Effluents from hydrochloric acid pickling problems and possible solutions : C. Bozec.

Double rinsing in galvanizing: Dr. Thomas H. Cook

Mechanical properties of galvanized steel

TIN AND ITS USES

No 126, 1980 :

Modern Radiator Manufacture : *C. J. Evans*

One of the most important engineering uses of tin-lead solder is in the construction of copper-bass radiators for automobiles The ease with which soldered joints can be made and their subsequent long-term reliability in service have contributed much to cost effectiveness of this type of radiator and, up to now, to the established preference of industry for this system over alternative materials and methods of construction.

The advances in radiator manufacturing equipment which have been described in this article have increased possible production rates and have decreased the reliance of successful manufacture on the availability of skilled operatives. This is likely to be an important factor in ensuring the continued well-being of the soldered copper radiator.

Organotins in Agriculture : *Organotin biocides are finding increasing application in agriculture. In this series of papers, researchers describe the progress which is being made in the field and review developments* : *Part 1* : *The Currently Used Organotin Plant Protection Agents* : *B Sugavanam.*

Part 2 : *Organotins in Kenyan Agriculture* : *F. E. Smith*

Tin in Plain Bearings :

Detailed informtion on all these bearing materials is contained in a new I.T.R.I. Handbook which will be available shortly. The publication contains details of plain bearing requirements, methods of manufacture and testing, types of defect and methods of avoidance, new developments in bearing material research and standard specifications.

Recent Developments in Pewter : *Sandra King*

No. 127 1981 : *Mass-soldering Equipment for the Electronics Industry Part 1 Wave Soldering* : *S. Karpel.*

Hydrophobic Organotin Compounds : *H Plum*

I T R I Research : *Cladding with Tin by Roll Bonding*

J. Electrochem. Soc. India

Organotins in Agriculture : This one of a series of paper in which researchers describe developments in the use of organotin biocides in agriculture. *Part 3 Organotins as Antifeedants and Feedings Deterrents* : *Susan Haynes.*

No. 128 1981 : *Mass-Soldering Equipment for the Electronics Industry Part 2 Drag and dip soldering* : *S. Karpel.*

In the first part of this article, the theory of wave soldering, together with a selection of commercial equipment used for this technique, was described. Part 2 of this review is concerned with the other major automated mass-soldering techniques, namely drag-and dip-soldering.

Tinned Steel Fuel Tanks for Alcohol Powered Vehicles : *T. A. Williamson.*

Tin Chemicals for Colouring Glass : *E. Greenwood.*

I.T.R.I. Research : *Autocatalytic Deposition of Tin.*

Organotins in Agriculture :

This is one of a series of papers in which developments in the use of organotin biocides in agriculture are described. *Part 4* : *Peropal-A New Organotin Miticide* : *S. King.*

GOLD BULLETIN

Volume 13, No. 4, October 1980 :

The Role of Gold in Silicon Thyristors : *David C Northrop.*

Silicon thyristors are widely applied in controlling the power input to devices ranging in scale from domestic light dimmers to the megawatt electric motors in steel rolling mills. This article outlines the principles of operation of thyristors and highlights the role of gold, first in achieving their rapid transition from the conducting to the non-conducting state, and secondly in the simultaneous creation of n-type layers on the silicon and of electrical contacts to these layers.

Gold Based Enamel Colours : The constitution and Applications of Purple of Cassius : John Carbert.

The most effective means of producing enamel colours ranging from pink to maroon is still based upon the purple preparation of colloidal gold first devised three hundred years ago. This article discusses the many conflicting views that have been expressed on its constitution and goes on to describe modern methods of production and use.

Gold in Plants : Christine A. Girling and J. Peterson

Many plants have the ability to take up gold from the soil and to accumulate it in their tissue. Advances have been made in our understanding of these processes to the point where their exploitation, particularly in the field of prospecting for gold, appears practically feasible.

The Movement of Atoms in a Gold Crystal : Recent Achievements in high Resolution Electron Microscopy.

The Use of Gold in Dentistry : An Historical Overview Part II : J. A. Donaldson.

Volume 14, No. 1, January 1981 :

Diffusisn and Reactions in Gold Films : A Review of Fundemental Aspects : John M. Poate.

The processes of interdiffusion and chemical reaction in thin film systems are of great scientific and technologicol interest, and our understanding of them has been greatly helped by the study of gold films. In this review the author deals with fundamental advances in this field with particular reference to the systems of importance to the electronics industry.

Tarnish and Corrosion Behaviour of Dental Gold : alloys Leon W. Laub and John W. Stanford.

For many years the specification of alloy composition, particularly high gold and platinum contents was considered sufficient to guarantee the stability of dental prostheses in the oral environment. This article reveals a considerably more complex situation and stresses the need for extensive laboratory and clinical testing of new alloy formulations before these may be unreservedly recommended to practitioners.

New White Gold Alloys : Their Development on the Basis of Quantitative Colour Assessment : I Bruce MacCormack and John E. Bowers

Modification of the colour of gold by the addition to it of other metals is important for jewellery applications. The potential of modern equipment for measuring spectral reflectance for the identification of promising new white carat gold compositions is illustrated by this account of a study of the bleaching and other effects of various metals incorporated in 18 carat jewellery alloys containing 10 per cent palladium.

Micromorphological Studies of the Corrosion of Gold Alloys : A. J Forty.

Considerable insight into the detailed mechanisms by which metals are corroded can be derived from direct microscopic observations. This article describes those micromorphological changes occurring near the surface that can be observed by transmission electron microscopy after gold alloys have been subjected to anodic dissolution in strong acids. These observations are used to discuss the important problem of corrosion by selective dissolution.

Volume 14, No 2, April 1981

Contacts/1980 : Research on Gold Presented at Major Conferences : Morton Antler.

The tempo of research on gold in electrical contacts has increased, spurred by the desire to optimize performance at least cost. This review highlights significant findings presented during 1980 at the International Conference of Electric Contact phenomena in Budapest, the Holm Conference of Electrical Contacts in Chicago and the Annual Symposium of the Electronic Connector Study Group, Inc. held in Philadelphia.

Dental Gold Alloys : Composition, Properties and Applications : Helmut Knosp, Mirza Nawaz and Manfred Stumke.

The special qualities called for in materials for restorative and corrective dental devices have led to the develodment of a wide variety of dental alloys. Gold alloys, ranging from simple to very complex,

are available which satisfy the technical and aesthetic needs of both practitioners and technicians.

A New Gold Refining Facility : Modernized and Expanded Complex for A Wide Range of Refinable Materials : *F. T. Embleton.*

An extensive programme of modernization of Johnson Matthey's refineries now provides them with the largest capacity world-wide for the evaluation and efficient processing of a great variety of materials containing gold and other precious metals.

Grain Size of Gold and Gold Alloys : A Review and Some Recent Developments : *Dieter Ott and Christoph J. Raub.*

Although the use of grain refining agents in dental gold casting alloys is well documented. little has been written concerning the use of such agents in casting and other gold alloys used in jewellery fabrication. This review of the control of grain size in gold alloys includes reference to recent findings regarding the use of cobalt in carat gold alloys.

Gilding Through the Ages : An Outline History of the Process in the Old World : *Andrew Oddy.*

CORROSION & MAINTENANCE

Volume 3, No. 3, July/September 1980

Seven Articles on Stainless Steels Covering new alloy steels, application in Industries and future trends.

Volume 3, No. 4, Oct-Dec. 1980

The issue contains selected papers on Reliability through failure analysis, techniques, typical case studies and maintenance.

Volume 4, No. 1, January-March 1981

The issue contains articles on Industrial Flooring Protection, Maintenance, Care studies, research and general articles on corrosion.

CIRCUIT WORLD

Volume 7, No 1 1980

Measuring the Thickness of Coatings on Printed Wiring Boards : T. D. T. Latter.

The Beta Backscatter Coating Thickness Gauge has been a very well used "tool" in printed wiring production for many years. The increased requirement fo more closely control the quality and cost of high priced materials and processes has been met by instrument developments utilising microprocessors, not only for measurement but also for instrument, operator and results evaluation. Despite this, the instrumentation will only deliver the correct results if given correct information in the first place, thus, the operator must know a little of thep receeding coating process or at least be given the relevant and correct information.

This paper describes the importance of the substrate material and the density of the coating material when measuring coating thickness.

The Use of the Laser for the Inspection of Printed Circuit Boards and Laminates : *J. Bedford.*

Scanned Helium-Neon laser beams are finding increasing use for noncontact industrial inspection applications where high resolution detection of optical properties of materials and components is required.

Using such devices, surface abnormalities in bare printed circuit laminates such as inclusions, pores and scraches can be readily detected. An important new application involves inspecting the quality of etched printed circuit planes using powerful pattern processing techniques to allow the detection of such faults as thin tracks ; narrow gaps ; holes missing, extra, misplaced or of the wrong size ; and under and over etch.

The paper describes the results of work proceeding to develop a Laser Scanner System designed specifically for printed circuir inspection which is capable of monitoring these faults.

Volume 7, No. 2, 1981

Using Hydrogen Peroxide/Sulphuric Acid Spray Circuit Etchant : *Fred W. Kear.*

Among the many types of printed circuit board etchant now available, there are a variety of notable advantages and disadvantages. This is confusing to the PCB manufacturer because all of these etchants work relatively well. In order to assess the advantages of a given etchant properly, the circuit engineer must consider all aspects of its use including its effect on plant effluents and the difficulty of recovering etched copper from solution. Peroxide sulphuric etchant offers distinct advantages in these areas of peripheral cost, as discussed in detail in his paper.

Screen Printing for Printed Circuit Boards : *C. A. Walter.*

Silk screen printing is a much used method of producing the required images on printed circuit boards. This paper discusses in detail the techniques and limitations of the process.

Treatment of Copper Surfaces in Printed Circuit Manufacture : *G. D. M. Menzies.*

Copper surfaces of laminates can be damaged by abrasively brushing prior to chemical processing. This is especially important where gold plated edge connectors are mede to the latest post Office specification of 2.5 μm. Chemical rather than abrasive treatment results in a pore-free surface which is vital when the gold is thin.

Volume 7, No. 3 1981 :

Quality Assessment : 18-Dip Insertion Damage : *Ronald A. Bulwith.*

Electron Beam Lithography at the Rutherford Laboratory : *R. A. Lawes.*

The Science Research Council has opened a mask-making facility at the Rutherford Laboratory based on the EBMF-2 Electron Beam Microfabricator. Ancillary equipment designed to support the EBM resolves features down to 1 micron or below, The paper discussed the EBM and outlines mark manufacturing procedure.

Costing a Printed Circuit Board : *Brian O'Hara*

This paper outlines a practicle method of working out the true cost of producing PCBs which, with the addition of profit margins, will give the selling price. Following a brief reference to various 'rule of thumb' methods, the paper will examine the labour, material and overhead cost associated with each particular process operation, the planning of a suitable costing and will cover all the important parmeters with the accent on simplicity. Performance of the levels assessed, together with the question of quality.

Effluent Treatment and Water Conservation in the Printed Circuit Industry : *M. J. Hutt.*

The pretreatment, electroplating and etching processes used by the PCB industry are unique in comparison with the plating industry generally. This paper deals with the treatment of the various sources of effluent, bearing in mind the stringent and strictly controlled quality standards.

This paper also examines the various sources of effluent and the problems they present. The extent to which high purity water is required is discussed, as are the considerations to be made with regard to water recirculation and conservation in general.