

ABSTRACTS

of current literature on the platinum metals and their alloys

PROPERTIES

Magnetic Properties of Supported Platinum-Iron Alloys

C. H. BARTHOLOMEW, J. H. ANDERSON and M. BOUDART, *J. Chem. Soc., Faraday Trans. 1*, 1979, **75**, (2), 257-261

The magnetic susceptibility χ of small particles of Pt-Fe alloys was measured on 9.4 wt.% Pt-Fe (90/10)/C (where 9.4 wt.% is a mixture of 9.4% metal alloy and 90.6 wt.% C and (90/10) refers to the respective molar % of Pt and Fe in the alloy) and 12.1 wt.% Pt-Fe (50/50)/C, at 77-700K in H_2 and O_2 . High temperature values of χ correspond to the paramagnetic behaviour of bulk alloys, whereas low temperature values indicate superparamagnetism. At room temperature, H_2 removes only part of O_2 preadsorbed at the surface of these alloys.

Clusters and Surfaces

E. L. MUETTERTIES, T. N. RHODIN, E. BAND, C. F. BRUCKZER and W. R. PRETZER, *Chem. Rev.*, 1979, **79**, (2), 91-137

A review of cluster and surface chemistry is presented. The metal cluster family, including all platinum group metal clusters and their crystallographic structures, and molecular clusters with their structural details for halide, carbonyl, binary isocyanide, sulphur and other molecules are examined. Structural comparisons between the chemisorbed state and metal clusters by various adsorption studies are stated, and thermochemical quantities are discussed. (295 Refs.)

Low-Temperature Specific Heat of Glassy and Crystallised $Pd_{0.775}Cu_{0.06}Si_{0.165}$ Alloys

J. C. LASJAUNIAS, A. RAVEX and D. THOULOZE, *J. Phys. F: Metal Phys.*, 1979, **9**, (5), 803-814

The specific heats of $Pd_{0.775}Cu_{0.06}Si_{0.165}$ alloys were measured between 30 mK and 1-2K successively in glassy and polycrystalline phases obtained by annealing at 400-550°C. Specific heat was dominated by a hyperfine T^{-2} term at below 80 mK, almost independent of the structure. The short-range order remained almost unchanged from the crystalline to the glassy states.

The Wear Resistance of a Liquid Quenched Metallic Glass

P. G. BOSWELL, *J. Mater. Sci.*, 1979, **14**, (6), 1505-1507

The relative wear resistances of amorphous and partially crystalline specimens of a liquid-quenched $Pd_{78.1}Cu_{5.5}Si_{1.64}$ alloy were measured. Plots were drawn of the average wear rates for the

two alloys, and also of the Vickers hardness ratios as a function of the maximum temperature of the amorphous alloy. Wear rate and hardness decreased slightly between 640-690K, then increased dramatically at ~700K, then dropped away as rapidly. This behaviour implies that the wear resistance of the partially crystalline alloy is mostly controlled by crack nucleation and growth and not by specimen hardness.

Photoemission (XPS, UPS) Studies of Pd-Si Metallic Glasses

P. OELHAFEN, M. LIARD, H.-J. GÜNTHERODT, K. BERRESHEIM and H. D. POLASCHEGG, *Solid State Commun.*, 1979, **30**, (10), 641-644

The valence bands of glassy $Pd_{100-x}Si_x$ ($15 \leq x \leq 21$) and pure Pd were studied by XPS and UPS. The band spectra of the alloys show a strongly reduced density of states at the Fermi energy, E_F , compared to Pd. The electron states near E_F for the glassy alloys have mainly d-character. This agrees with recent measurements of low temperature specific heat, the magnetic susceptibility and the optical reflectivity.

On the Extremely High Thermodynamic Stability of Pd-Th Alloys

H.-J. SCHALLER, *Z. Naturf. A*, 1979, **34**, (4), 465-468

The thermodynamic properties of Pd-Th solid solutions containing 0-16 at.% Th were determined at 700-800°C with CaF_2 solid electrolyte cells. The mixing behaviour of the alloys is characterised by extreme negative deviations from ideality, up to -410J/mol for the partial molar excess free energy of Th. The great stability is attributed to electronic interactions brought about by the transfer of the Th valence electrons to the electron gas of the alloy.

An Investigation of Some Palladium-Titanium and Some Palladium-Titanium-Hydrogen Alloys

J. EVANS, I. R. HARRIS and L. S. GUZEI, *J. Less-Common Metals*, 1979, **64**, (2), P39-P57

Powdered and solid Pd-Ti alloys containing 0-30at.%Ti were investigated. The lattice spacings in the solid samples indicate a small progressive contraction of the Pd lattice on adding Ti, except for the range 7-14.5% Ti where the spacing remains constant. This region may be due to the compensatory effects of ordering and of adding Ti. Magnetic susceptibility measurements up to ~9% Ti indicate Ti atoms have a valency of 4 in solutions of Pd. On hydrogenation Pd-Ti alloys containing 0-8.7% Ti were harder than the equivalent Pd-Ce solid solution alloys.

Superconducting and Normal State Properties of ErRh_4B_4 and LuRh_4B_4

L. D. WOOLF, D. C. JOHNSTON, H. B. MACKAY, R. W. MCCALLUM and M. B. MAPLE, *J. Low Temp. Phys.*, 1979, **35**, (5/6), 651-669

Heat capacity measurements of ternary compounds ErRh_4B_4 and LuRh_4B_4 were performed between 0.5 and 36K in magnetic fields up to 4kG, yielding new information on crystal field effects in these materials and on the influence of externally applied magnetic fields on the coupled superconducting-ferromagnetic reentrant transition in ErRh_4B_4 . Static magnetic susceptibility data on LuRh_4B_4 are presented, and the electrical resistivity of ErRh_4B_4 was determined between 4K and room temperature.

The Effect of Trace Element Additions on the Grain Boundary Composition of Ir+0.3 Pct W Alloys

C. L. WHITE, R. E. CLAUSING and L. HEATHERLY, *Metall. Trans.*, 1979, **10A**, (6), 683-691

The grain boundary fracture surfaces of several Ir+0.3%W alloys were examined by AES. Dopant additions (10-80 wt.ppm) of Th result in a Th enriched grain boundary of only a few atom layers thickness. The Th segregation inhibits grain boundary fracture during high temperature impact of the alloy, which is utilised for cladding radioactive fuel in radioisotope thermo-electric generators. (48 Refs.)

Experimental and Theoretical Study of Short Range Order in Ni-Os and Co-Os Alloys

A. A. KATSNEL'SON, A. O. MEKHRABOV and V. M. SILONOV, *Fiz. Metal. Metalloved.*, 1979, **47**, (5), 993-997

X-ray analysis and a pseudopotential method were used to study the short range order in Ni-Os and Co-Os systems. It is shown that local short range order exists in Ni-1.5 at.% Os and Co-1.5, 1.3, 0.5 at.% Os alloys. The energy of ordering and the short range parameters were calculated.

CHEMICAL COMPOUNDS

Synthesis of Platinum(II) Tetraamine Complexes and Investigation of Molecular Electroconductivity of Their Aqueous Solutions

N. N. ZHELIGOVSKAYA, E. P. KRASOVSKAYA and L. V. POPOV, *Vestnik Moskov. Univ., Ser. II Khim.*, 1979, **20**, (3), 261-264

Mixed *trans*-tetraamine complexes of the following types were prepared and studied: $[\text{Pt}(\text{NH}_3)_2\text{Am}_2]\text{Cl}_2$ where Am is methylamine, ethyl amine, diethyl amine, etc., and also *cis*- $[\text{Pt}(\text{NH}_3\text{Py}_4)_2]\text{Cl}_2$ and $[\text{PtPy}_4]\text{Cl}_2$ where Py is pyridine. New *trans*- $\text{Pt}(\text{NH}_3)_2(\text{t-C}_4\text{H}_9\text{NH}_2)_2\text{Cl}_2$ was obtained. The results showed that mobility of the complex cations decreased with the increase of the size of the amino ligands.

A Versatile Starting Material: Substitution Reactions of Bis(acetato)bis(diethyl sulfide)-platinum with Phosphines, Thiols, o-Hydroquinones and Dihydroxybenzoquinones

J. KUYPER, *Inorg. Chem.*, 1979, **18**, (6), 1484-1489
A new compound *cis*- $\text{Pt}(\text{OAc})_2(\text{Et}_2\text{S})_2$ has been prepared and used as a starting material in the synthesis of many new Pt complexes. Substitution reactions produced both *cis*- $\text{Pt}(\text{O-O})(\text{Et}_2\text{S})_2$ and *cis*- $\text{Pt}(\text{O}_2\text{-O}_2)(\text{Et}_2\text{S})_2$ compounds. Other compounds synthesised by various stages were *trans*- $\text{Pt}_2(\mu\text{-}(\text{O}_2\text{-O}_2))_2(\text{Et}_2\text{S})_4$, $\text{Pt}(\text{SAr})_2(\text{EtS})_2$, $[\text{Pt}(\text{SAr})_2]_n$, mono- and bis-substituted phosphine compounds and $\text{PtI}_2(\text{Et}_2\text{S})_2$, etc. Both the acetato or sulphide groups were readily substituted simultaneously or separately in high yield.

ESR and Optical Studies on the Interaction between *cis*-Dichlorodiammine Platinum(II) and Tryptophan

H. NEUBACHER, P. ZAPLATYNSKI, A. HAASE and W. LOHMANN, *Z. Naturf. B*, 1979, **34**, (7), 1015-1018
cis-Dichlorodiammine Pt(II), which is known to be an active anti-tumour compound, and tryptophan form paramagnetic complexes in aqueous solution. These were detected by electron spin resonance spectroscopy (ESR) after a reaction time of several hours. The ESR spectra are due to Pt(III) in a low spin d^7 configuration. The optical studies suggest columnar structures for the paramagnetic complexes.

Krypton and Xenon Inclusion Compounds of Complex Metal Cyanides

M. KÄMPER, M. WAGNER and A. WEISS, *Angew. Chem. Internat. Ed. En.*, 1979, **18**, (6), 486-487

The structure of $\text{CdPt}(\text{CN})_6 \cdot 1.046\text{Kr}$ and $\text{CdPt}(\text{CN})_6 \cdot 1.128\text{Xe}$ crystals were examined after synthesis. The host compound $\text{CdPt}(\text{CN})_6$ has space group $\text{Fm}\bar{3}\text{m}$. These compounds have high stability and may provide a technically interesting alternative to the storage of gases in steel cylinders. In the Kr compound, Kr is present at a density corresponding to that of an ideal gas at 118 bar. If all the host lattice cavities, which are hydrophobic, are occupied by preparation at higher pressure this value rises to 216 bar.

ELECTROCHEMISTRY

The Effect of Iodide on the Electrochemical Reduction of Thick Oxide Films Formed on Platinum Electrodes in Sulfuric Acid Solution

S. SHIBATA and M. P. SUMINO, *J. Electroanal. Chem. Interfacial Electrochem.*, 1979, **99**, (2), 187-195

The reduction of thick oxide films formed on Pt under severe anodic conditions was studied in the presence of adsorbed I^- . A Pt electrode with a reduced superficial monolayer oxide on the thick

oxide adsorbs I^- . Iodide adsorbed on its surface blocks the adsorption of hydrogen and greatly slows down the cathodic reduction of the inner thick oxide remaining. The results showed that the reduction rate of the inner oxide depends only on the coverage by hydrogen, which coexists with adsorbed I^- .

New Developments in Platinum Type Anodes

R. BABOIAN, *Mater. Performance*, 1979, **18**, (1), 9-15

Developments in Pt clad Nb anodes for cathodic protection in sea water, deep wells and underground are described. Low porosity of roll clad Pt-Nb and resistance of Nb to breakdown in chlorides at up to 120V improves sea water performance in drill rigs, heat exchanges and pipelines. Soil burial in carbonaceous backfill reduces Pt attrition because current is transferred from the Pt to the C where the anode reactions occur. Reinforced Pt clad Nb sheet or mesh anodes are used in sea water, deep wells and soils, while probe anodes are used in heat exchanges.

Electrochromism in Anodic Iridium Oxide Films. II. pH Effects on Corrosion Stability and the Mechanism of Coloration and Bleaching

S. GOTTESFELD and J. D. E. MCINTYRE, *J. Electrochem. Soc.*, 1979, **126**, (5), 742-750

The oxidation state of Ir ions in an oxide film, grown electrochemically and an Ir metal reflector electrode can be rapidly and reversibly modulated: $Ir(OH)_n(\text{transparent}) \rightleftharpoons IrO_x(OH)_{n-x}(\text{blue-black})$. By suitable choice of electrolyte the colour-bleach process can occur without causing film growth on dissolution; in weakly acidic solutions the bleach rate is quick since H_2O molecules in the film pores and/or H_2O or OH groups provide protons at the oxide/electrolyte interface. This system has a broad spectral absorption, good contrast, fast response, good corrosion stability, useful for display devices.

Excited-State Photochemistry in the Tris-(2, 2'-bipyridine)Ruthenium(II)Sulfite System

C. CREUTZ, N. SUTIN and B. S. BRUNSCHWIG, *J. Am. Chem. Soc.*, 1979, **101**, (5), 1297-1298

Three efficient photochemical methods for generation of $Ru(bpy)_3^{+}$ in aqueous solution are described. Both excited $Ru(bpy)_3^{2+}$ and $Ru(bpy)_3^+$ are excellent reducing agents and may be useful as mediators in photoproduction of secondary species capable of bringing about the rapid reduction of water to H_2 . $Ru(bpy)_3^+$ could be of greater practical value than excited $Ru(bpy)_3^{2+}$, because of its great reducing power and also because the back reaction is less favourable and so slower. The photolysis of $Ru(bpy)_3^{2+}/Q$ solutions ($Q = Eu^{2+}_{aq}$, SO_3^{2-} , HA^-) in the presence of possible H_2 precursors is being examined.

Photoelectrochemical Production of Hydrogen from the Tris(2,2'-bipyridine)ruthenium-NN'-Dimethyl-4,4'-bibipyridylum(Paraquat) System

B. DURHAM, W. J. DRESSICK and T. J. MEYER, *J. Chem. Soc., Chem. Commun.*, 1979, (8), 381-382

A photoelectrochemical cell, based on electron transfer quenching of the excited state $Ru(bpy)_3^{2+}$ ($bpy = 2,2'$ -bipyridine) is described. In the cell visible photolysis gives both H_2 and an appreciable photocurrent.

ELECTRODEPOSITION AND SURFACE COATINGS

Obtaining Diffusion Heat-Resistant Coatings on Niobium

V. F. SHATINSKI, V. V. DROBIT, M. S. GOIKHMAN and M. F. ZAMORA, *Zashchita Metal.*, 1979, **15**, (3), 373-375

Diffusion heat resistant coatings on Nb alloys, prepared by diffusion metallisation from liquid Ca solution with 5 wt.% Pt, Re, Ge, etc. were studied in air at 800-1100°C. A linear dependence of the rate of oxidation on the temperature of Pt coated surfaces was obtained. Activation energy of the oxidation process was 14.8 kcal/mol for Pt. Kinetic mechanisms and oxidation parameters of multicomponent coatings, consisting of solid base Pt, Si, Cr containing carbide systems, are given.

Effect of Pt Ion Plating on the Creep Behavior of Alpha Ti

S. FUJISHIRO and D. EYLON, *Scripta Metall.*, 1979, **13**, (3), 201-203

Samples of Ti and Ti-5Al-2.5Sn were Pt ion plated to find its effect on the creep behaviour of the samples. Creep tests in air were performed. Bare or coated α -Ti wire exposed to air showed no difference in creep behaviour. It is thought that O_2 induces transformation of phase boundary β to α phase with concurrent generation of additional mobile dislocations. However, ion plating may be effective in increasing air creep strength for Ti alloys containing the β phase, at test temperatures.

A Study of the Products of Ultraviolet Irradiation of Palladium-Containing Catalysts for Electroless Metal Deposition

B. K. W. BAYLIS, C.-C. HUANG and M. SCHLESINGER, *J. Electrochem. Soc.*, 1979, **126**, (3), 394-397

The effect of u.v. light on the Sn-Pd species used in electroless metal deposition using Sn(II) and Sn(IV) solutions as the sensitiser was studied. With irradiated Sn(IV)-Pd, less Pd was rinsed off during the post activation rinse than from the non-irradiated species, indicating that the light does not simply break the bonding attaching the Pd, allowing it to be rinsed off. When Sn(II) is the sensitiser more Pd seems to be found.

Evaluation of an Improved Ruthenium Plating Process

T. A. PALUMBO, *Plating Surface Finish.*, 1979, **66**, (8), 42-44

An improved Ru plating process was evaluated using a buffered acid solution of $K_3[Ru_2N(H_2O)_2Cl_8]$ in a small scale plating cell to plate reed contacts with a 1 μm layer of Ru over 1 μm of soft Au. The Ru electrolyte remained stable during evaluation and had a constant cathode efficiency. The Ru deposits were pure and had lower stresses and remained crack free after thermal shock testing. Ru is an excellent contact material. It is not attacked by hot or cold acids or aqua regia.

HETEROGENEOUS CATALYSIS

Automotive Exhaust Emissions Control Using the Three-Way Catalyst System. I. Computer Simulation of the NO-H₂-O₂ Reaction on Pt/Al₂O₃ Catalyst

A. MIYAMOTO, B. INOUE and Y. MURAKAMI, *Ind. Eng. Chem., Prod. Res. Dev.*, 1979, **18**, (2), 104-109

The kinetics of the NO-H₂-O₂ reaction on a Pt/Al₂O₃ catalyst were studied by a method of computer simulation. The calculations showed the existence of a space where all the NO, NH₃, H₂ and O₂ can be removed simultaneously. NH₃ played an important part as an intermediate in the reaction. Directions for the improvement of Pt/Al₂O₃ as a catalyst are suggested. The computer simulation was useful for the analysis of a complex system, such as the three-way catalyst system.

Production of 1-Naphthol on Rhenium-Platinum Catalysts

V. V. SOBOLEV, D. A. SIBAROV, A. B. UGLOVOI and V. A. PROSKURYAKOV, *Zh. Priklad. Khim.*, 1979 **52**, (1), 450-452

Studies of dehydrogenation of 1-tetralone on Re-Pt/ γ -Al₂O₃, Pt/ γ -Al₂O₃ and Re/ γ -Al₂O₃ catalysts promoted with K₂O were carried out in a flow reactor at 300-450°C. Re-Pt/ γ -Al₂O₃ catalysts showed similar activity to the mono-metallic catalysts. The most active were 0.5% Re-0.2%Pt/ γ -Al₂O₃ catalysts yielding 96% 1-naphthol for an 84% conversion of 1-tetralone at 375°C.

Reaction of Sulfur Oxides with Alumina and Platinum/Alumina

J. C. SUMMERS, *Environ. Sci. Technol.*, 1979, **13**, (3), 321-325

At temperatures > 500°C, very little SO₂ is adsorbed on Al₂O₃ in the absence of O₂ and noble metals. With O₂ present, significant quantities of SO₂, above those occurring independently in the gas phase, are oxidised to SO₃

and stored on the Al₂O₃. Pt enhances the SO₂ storage rate on Al₂O₃. In the absence of O₂, Pt appears to catalyse the disproportionation of SO₂. With O₂ present in the feedstream, Pt catalyses the oxidation of SO₂. SO₂ and SO₃ adsorb on different Al₂O₃ sites, but SO₃ adsorption does not affect the SO₂ adsorption rate.

Palladium-Catalyzed Hydrogenation of Soybean Oil

M. M. AHMAD, T. M. PRIESTLEY and J. M. WINTERBOTTOM, *J. Am. Oil Chem. Soc.*, 1979, **56**, (5), 571-577

The hydrogenation of soybean oil was studied using various Pd/C catalysts at H₂ pressures between ambient and 70 psig and at temperatures from 80-160°C, and compared with commercial Ni catalysts. Pd catalysts with the metal on the exterior of the support were the most active and selective at ambient pressures. However, Pd catalysts with metal in the charcoal pore system were the most active at higher H₂ pressures. Pd catalysts produced more trans-acids than Ni and the selectivity of Pd was superior to that of Ni and 15-20 times greater.

Catalysis by Supported Transition Metal Complexes. X. Study of Ionic Exchange and Role of Hydroxyl Groups on Palladium Resins

H. DUPIN, J. SABADIE, D. BARTHOMEUF and J. E. GERMAIN, *Bull. Soc. Chim. Fr. I*, 1979, (3/4), 86-90

The selectivity of Pd/resin catalysts, active after reduction of the liquid phase hydrogenation of allyl alcohol to propanol, is directly related to the density of OH⁻ groups on the support with a maximum value of 80%. HCl addition decreased the selectivity to ~50% while NaOH addition to the catalysts increased their selectivity in the same reaction to ~75%. The support effect is therefore ascribed to the OH⁻ groups left on the resin due to incomplete exchange with Pd salts.

Active States of Rhodium Exchanged Y Zeolite Catalysts for Hydrogenation of Ethylene and Acetylene and Dimerization of Ethylene Studied with X-Ray Photoelectron Spectroscopy

Y. OKAMOTO, N. ISHIDA, T. IMANAKA and S. TERANISHI, *J. Catalysis*, 1979, **58**, (1), 82-94

Rh-Y zeolite catalysts were investigated by X-ray photoelectron spectroscopy. Rh(I) was formed in Rh-Y zeolites as a significantly stable intermediate during the reduction of Rh(III) to Rh by heat treatment. The Rh(I) in Rh-Y zeolites was active for the hydrogenation and dimerisation of ethylene, whereas Rh metal was active for the hydrogenation of both ethylene and acetylene. Strong correlations were established between homogeneous Rh complex catalysts and Rh-Y catalysts both in the active oxidation states of Rh and in the effect of additives on the reactions.

Decomposition of Ammonia on Ru/Al₂O₃ Catalysts with Various Dispersities

D. V. SOKOL'SKII, T. V. KUZORA and A. B. FARMAN, *Zh. Priklad. Khim.*, 1979, **52**, (4), 737-740

Studies of the decomposition reaction of NH₃ on 3 wt. % Ru/Al₂O₃ catalysts with the grain sizes ranging from 0.05 to 3 mm were performed in a flow apparatus at 300-500°C. Diffusion inhibition was observed on samples with grain sizes of >1 mm at >400°C. Thus, activity of the catalyst and the activation energy increased due to only a small part of the surface being available.

HOMOGENEOUS CATALYSIS

Platinum-Diphosphine-Tin Systems as Active and Selective Hydroformylation Catalysts

Y. KAWABATA, T. HAYASHI and I. OGATA, *J. Chem. Soc., Chem. Commun.*, 1979, (10), 462-463

The activity of the PtCl₂(PPh₂)₂-SnCl₂ complex as a hydroformylation catalyst was dramatically enhanced by the use of diphosphine ligands which were capable of forming a strained seven-membered chelate ring. The best ligand was *trans*-1,2-bis(diphenylphosphinomethyl) cyclobutane which gives hexanals (n/iso=99/1) from pent-1-ene with a much higher reaction rate than by the use of HRh(CO)(PPh₃)₃.

Chemistry of Metal Hydrides. XXIII. Catalytic Hydrogenation of Olefins Using *trans*-PtH(NO₃)(PEt₃)₂ as Catalyst

H. C. CLARK, C. BILLARD and C. S. WONG, *J. Organometal. Chem.*, 1979, **173**, (3), 341-347

The catalyst *trans*-PtH(NO₃)(PEt₃)₂ was found to be active for the hydrogenation of olefins. While it is active towards both internal and terminal olefins, it is not effective towards olefins with electron-withdrawing substituents. The hydrogenation is most effective when conducted in methanol at 60°C and 600 psi. The markedly enhanced activity of the catalyst in methanol compared with acetone or methylene chloride is discussed.

Potassium-Dinitrogen-Ruthenium Complex as an Active Catalyst for Nitrogen Fixation

A. OHYA, K. URABE, K. AIKA and A. OZAKI, *J. Catalysis*, 1979, **58**, (2), 313-319

K uptake by Rh is enhanced and stabilised by the presence of N₂, with a significant N₂ uptake. The K uptake is stable, even during evacuation at 350°C and is stoichiometrically related to N₂, suggesting that ternary compound (KN₂Ru)_n is formed. Electrical resistance of Ru film is decreased slightly by (KN₂Ru)_n. The K adsorbed increases the activity for the isotopic equilibration of N₂. Evidence for the dinitrogen nature of the compound is supported by hydrazine, NH₃ and a dinitrogen complex of Ru formed upon hydrolysis as well as ethanolysis.

Photoactivation and Photosensitisation of Homogeneous Hydrogenation Catalyst IrCl(CO)[P(i-C₃H₇)₃]₂

W. STROHMEIER and J.-P. STASCH, *Z. Naturf. B*, 1979, **34**, (5), 755-758

Under irradiation with monochromatic light of λ ≤ 407nm, homogeneous hydrogenation of acrylic ethylester with IrCl(CO)[P(i-C₃H₇)₃]₂ was much faster than in the dark due to the photochemical activation of the hydrido complex.

CHEMICAL TECHNOLOGY

Solvent Extraction in Platinum Group Metal Processing

M. J. CLEARE, P. CHARLESWORTH and D. J. BRYSON, *J. Chem. Technol. Biotechnol.*, 1979, **29**, (4), 210-224

The various ways in which the chemistry of the platinum group metals (PGM) is manipulated to achieve separations using solvent extraction techniques is indicated. Mechanisms of solvent extraction processes are discussed and related to PGM complex chemistry. Potential economic advantages for solvent extraction over conventional precipitation processes are considered.

ELECTRICAL AND ELECTRONIC ENGINEERING

Characterization of Thick Film Compositions on Porcelain Steel Substrates

T. R. ALLINGTON and R. E. COTE, *Solid State Technol.*, 1979, **22**, (1), 81-86

Pt-Ag+Pd-Ag compositions were printed and fired onto porcelain steel substrates and tested for adhesion, ageing, solder leach resistance and resistivity. Ageing tests were normal and resistivity results are comparable to those observed on 96% Al₂O₃ substrates; adhesion remained constant after 1000 hours at 150°C. These results are comparable with other substrates; however, porcelainised steel while needing more research, promises to be suitable as a low cost, large size substrate for use in thick film circuitry.

Interdiffusion and Degradation of Si/Cr/Pt/Ag IMPATT Diode Metallization

S. D. MUKHERJEE, D. V. MORGAN and M. J. HOWES, *J. Electrochem. Soc.*, 1979, **126**, (6), 1047-1053

Interdiffusion and degradation of Cr/Pt/Ag multiple metallisation layers for Si IMPATT diodes were studied. Grain boundary diffusion showed rapid initial growth and eventual saturation of solute Pt in Ag grains; and the effect of this on device failure caused by the possible depletion of the Pt barrier layer is discussed. Samples annealed in air showed substantial degradation of the Ag layer due to Cl₂ contamination. The Cr/Pt interface was stable up to 400°C but annealing at or above 500°C caused mixing.

Low-Temperature Sintering of Pd/Ge Films on GaAs

H. R. GRINOLDS and G. Y. ROBINSON, *Appl. Phys. Lett.*, 1979, **34**, (9), 575-577

Rectifying metal-semiconductor contacts, produced by heat treatment of a thin evaporated layer of Pd/Ge on n-type GaAs, were studied by Auger spectroscopy, X-ray diffraction and current-voltage measurements. During sintering at temperatures $< 350^{\circ}\text{C}$, Pd and Ge interdiffused on the non-reacting GaAs substrate forming PdGe and Pd₂Ge. The form of the germanide phases altered the Ge LMM Auger spectra and produced an increase in the Schottky barrier energy from 0.67 to 0.85 eV. In general, sintered contacts have greater planar contact surface than alloy contacts.

Comparative Study of Chemical and Polarization Characteristics of Pd/Si and Pd/SiO_x/Si Schottky-Barrier-Type Devices

L. L. TONGSON, B. E. KNOX, T. E. SULLIVAN and S. J. FONASH, *J. Appl. Phys.*, 1979, **50**, (3), 1535-1537

AES and ISS studies of the chemical nature of semitransparent ($\sim 125\text{\AA}$) Pd/Si Schottky-barrier type devices were performed. Pd silicide was formed in the metal-semiconductor structures, while the presence of an ultrathin ($\sim 30\text{\AA}$) purposely grown semiconductor oxide film inhibited the chemical reaction between Pd and Si in the metal overlayer. Chemical bonding information was correlated with barrier height.

MEDICAL USES

cis-Platinum: A New Anticancer Agent

C. J. WILLIAMS and J. M. A. WHITEHOUSE, *Br. Med. J.*, 1979, **1**, 1689-1691

A review of the drug platinum diamminodichloride (cisplatin) is presented, aimed at providing clinicians with information on the optimal methods of use, the toxicity and the anti-tumour effects of the drug.

NEW PATENTS

METALS AND ALLOYS

Nickel-Palladium Brazing Alloy

WESTERN GOLD & PLATINUM CO.

U.S. Patent 4,149,881

A brazing alloy which can be used as a cheaper alternative to 82Au-18Ni alloys contains 17-44% (36%) Pd, 4-11% (11%) Cr, 1-4% (2.2%) Si, 1.5-4% (2.1%) B and the balance (48.7%) Ni, and has a brazing temperature of about 1800°F. The preferred composition is given in brackets.

Co-ordinate Compounds with Potential Anti-Tumour Activity. I. Platinum and Palladium Complexes with Aminic Ligands

S. KIRCHNER, C. DRĂGULESCU, A. MAURER, V. TOPCIU and N. CSAKI, *Rev. Chim.*, 1979, **30**, (4), 321-326

A number of complexes of Pt(II) and Pd(II) of the *cis*-dichlorodiammine type with hydrazine and organic cyclic saturated amines have been prepared, characterised and tested in vitro and in vivo for their anti-tumour activity. Two of the complexes, one of Pt(II) and one of Pd(II), tested on *E. coli* B rods, led to deformed cells like methotrexate and exhibited quite good anti-tumour activity against Ehrlich ascites in a preliminary stage, but were almost inactive against advanced Ehrlich ascites.

Synthesis and Antimitogenic Activity of Some Co-ordination Compounds of Platinum(II), Palladium(II) and Rhodium(III)

A. VASSILIAN, A. B. BIKHAZI and H. A. TAYIM, *J. Inorg. Nucl. Chem.*, 1979, **41**, (5), 775-778

Complexes of Pt(II), Pd(II) and Rh(III) with 2,6-dimino-pyridine and its 4-methoxy and 4-ethoxy derivatives were prepared and their antimitogenic activity was measured. Pt(II) complexes showed high antimitogenic activity and low toxicity. Pt(II) complexes were moderately active, while Rh(III) complexes enhanced thymidine uptake. The behaviour of Rh(III) complexes was of particular interest because such complexes may exhibit anti-tumour activity by enhancing the immune response of the system.

Age Hardening of Ag-Pd-Cu Dental Alloy

M. OHTA, K. HISATSUNE and M. YAMANE, *J. Less-Common Metals*, 1979, **65**, (1), P11-P21

The age-hardening characteristics of Au containing Ag-Pd-Cu dental alloys were investigated. Compositions examined were Ag 49.3-52.5 at.%, Pd 24.5-29.3 at.%, Cu 15.3-21.0 and Au 2.6-6.5 at.%. Hardening was found to be due to the precipitation of a CuPd ordered phase, with a AuCu-I type face centred tetragonal structure.

ELECTROCHEMISTRY

Electrode for Electrolytic Cell

ESB INTERNATIONAL CORP.

British Appl. 2,009,491 A

A composite electrode, particularly for use in lead-acid batteries, has a porous body of Ti infiltrated with a metal and an outer layer of an electroconductive metal oxide to prevent electrolyte access to the electrode interior. The pores can be filled with Ru, Pb, Sn, Sb or Mn.