

ABSTRACTS

of current literature on the platinum metals and their alloys

PROPERTIES

Choice of Heat Resistant Alloys of the Pt-Pd-Rh-Au-Ir System

F. S. NOVIK, E. I. RYTVIN, L. A. MEDOVOY and L. P. ULYBYSHEVA, *Izv. Vyssh. Uchebn. Zaved., Tsvetn. Metall.*, 1980, (3), 107-110

The effect of various metals on the behaviour of complex Pt-Pd-Rh-Au-Ir alloys containing 10-60% Pd, 5-10% Rh with small amounts of Au and Ir, and the remainder Pt was studied during high temperature creep at 1000-1400°C. The results showed that Pt alloys containing 60% Pd and 10% Rh with small amounts of Au and Ir have, at 1400°C and with an initial tension of 0.5 kg/mm², approximately the same durability as more expensive alloys containing only 10% Pd.

The Application of Dark-Field Electron Microscopy to the Study of Short-Range Order in Alloys

J. P. CHEVALIER, *J. Microsc. (Oxford)*, 1980, **119**, (1), 113-124

Short-range order in quenched CuPt and quenched Ni₄Mo was studied by electron diffraction and high-resolution dark-field imaging. From the stereo images it was found that local ordering in CuPt was in the form of microdomains of the size 0.7-10 nm, and CuPt also had imperfectly ordered interlocking L1₁ microdomains.

Paramagnetic Susceptibility in Fe-Pt Invar Alloys

K. SUMIYAMA, M. SHIGA and Y. NAKAMURA, *J. Phys. Soc. Jpn.*, 1980, **48**, (4), 1393-1394

Paramagnetic susceptibility was measured in Fe-Pt Invar alloys containing 24-32 at.% Pt. The susceptibility-temperature curve obeys the Curie-Weiss law. Fe-Pt Invar alloys are itinerant ferromagnets. Spin fluctuation effects are important for understanding both the magnetic properties and the magnetovolume effects in these alloys.

The Influence of Magnetic Ordering on the Resistivity of PdMn Alloys

S. SENOSSI, A. HAMZIC and I. A. CAMPBELL, *J. Phys. F.*, 1980, **10**, (6), 223-229

The temperature dependence of the resistivity and the magnetoresistance of PdMn alloys are measured at concentrations of 1-10% Mn. The alloy orders quasiferromagnetically for concentrations of <4% Mn and as spin glasses for concentrations >4% Mn. The zero field temperature dependence of the spin glass alloy resistivity is mainly due to changes in the inelastic scattering rates.

Control of Solid Phase Epitaxial Growth in the Pd-Si System by Carbon Ion Implantation

H. ISHIWARA, S. SAITON and S. FURUKAWA, *Jpn. J. Appl. Phys.*, 1980, **19**, (5), 831-837

Solid phase epitaxial growth in the Si(100)/Pd/Si (amorphous) system can be controlled by implanted C⁺ ions. These are implanted into Pd or Si(a) films at energies of 50-160 keV after film deposition. The implantation doses were adjusted so that the maximum C⁺ concentration ranged from 0.25-4 at.% and the growth behaviour was measured. The best epitaxial layer was obtained when C⁺ ions were implanted near the interface between the Si(a) and Pd films, though the layer still contained residual Pd atoms at 1-2 at.%.

Interaction of Evaporated Palladium and Titanium Films with Single-Crystal Silicon

T. G. FINSTAD and M. A. NICOLET, *Thin Solid Films*, 1980, **68**, (2), 393-405.

Silicide formation with electron gun evaporated films of Pd and Ti was studied by various techniques. The results showed that Ti silicides grew on top of Pd₂Si at >500°C in samples with the structure (single crystal) Si/Pd/Ti. At 530-650°C, the growth rates of this layer on <111>-oriented substrates were the highest when an interposing Pd layer was present. For samples with the structure <100> Si/Pd/Ti annealing at >550°C yielded very laterally non-uniform layers. Samples with a Ti:Pd ratio of ~1:3 gave laterally non-uniform silicide formation.

New Magnetic Materials Derived from Chromium Dioxide

G. DEMAZEAU, P. MAESTRO, T. PLANTE, M. POUCHARD and P. HAGENMULLER, *IEEE Trans. Magn.*, 1980, **MAG-16**, (1), 9-10

A new method of preparation of CrO₂ from Cr₂O₃ is described. Cr₂O₃, Rh₂O₃ and 5H₂O give a solid solution, Cr_{1-x}Rh_xO₂ (0 < x < 1), with needle-like particles which is only magnetic for x ≤ 0.5. With low Rh contents (x = 0.001) coercive fields >500 Oe are attained. Materials with large coercive fields (>300 Oe) can be used for magnetic recording and the most suitable materials are commonly needle-like particles.

Diffusionless Phase Transformations of Ru₂Si₃, Ru₂Ge₃ and Ru₂Sn₃. II. Electrical and Magnetic Properties

C. P. SUSZ, J. MULLER, K. YVON and E. PARTHE, *J. Less-Common Met.*, 1980, **71**, (1), 1-8

The series Ru₂Ge_{3-x}Sn_x and Ru₂Ge_{3-y}Si_y compounds (0 ≤ x, y ≤ 3) were investigated using electrical

resistivity and magnetic susceptibility measurements. Except for Sn-rich compounds ($x > 2$), which are metallic, they are n-type superconductors and are diamagnetic. The forbidden energy gaps for Ru_2Si_3 and Ru_2Ge_3 are 0.44 and 0.34 eV, respectively. The gap increases discontinuously for all compounds while they undergo a first-order phase transformation into the low-temperature modification.

CHEMICAL COMPOUNDS

Insertion of L_2Pt^0 and L_2Pd^0 Carbenoids as Specified by Mercury-Phosphorus Bond in Reaction with Mercuric Salts of Dialkylphosphites

V. I. SOKOLOV, A. A. MUSAEV and G. Z. SULEIMANOV, *Izv. Akad. Nauk SSSR, Ser. Khim.*, 1980, (5), 1177-1179
Mono- and bisdimethylphosphites and derivatives bis(triphenylphosphine)Pt and bis(triphenylphosphine)Pd were prepared by the reaction of zero valence complexes of Pt and Pd with mercuric salts of dialkylphosphites. The obtained intermediate compounds exhibit Hg-Pt bonding.

A New Family of Ternary Intermetallic Superconducting/Magnetic Stannides

J. P. REMEIK, G. P. ESPINOSA, A. S. COOPER, H. BARZ, J. M. ROWELL, D. B. McWHAN, J. M. VANDENBERG, D. E. MONCTON, Z. FISK, L. D. WOOLF, H. C. HAMAKER, M. B. MAPLE, G. SHIRANE and W. THOMLINSON, *Solid State Commun.*, 1980, **34**, (12), 923-926

A new family of rare earth-Rh-Sn intermetallic compounds, $(\text{RE})\text{Rh}_x\text{Sn}_y$, has been synthesised in crystal form. Compounds with the heavier rare earths are superconducting and those with the lighter rare earths are generally magnetic. $\text{ErRh}_{1.1}\text{Sn}_{3.6}$ has reentrant superconductivity with $T_c = 0.97\text{ K}$ and $T_m = 0.57\text{ K}$. Syntheses and X-ray characterisations are described and physical properties given. This is the first class of compounds exhibiting superconductivity and magnetism where all constituents are metals.

ELECTROCHEMISTRY

Behaviour of Platinum in the Process of Electrolytic Refining of Copper by Reversed Current

A. I. ZHURIN and S. YU. PETROV, *Izv. Vyssh. Uchebn. Zaved., Tsvetn. Metall.*, 1980, (3), 72-74

Atomic absorption studies of the behaviour of Pt during electrolytic Cu refining by reversed current were made in H_2SO_4 electrolyte with Cu anodes containing 0.213-0.142%Pt. No dependence of the Pt transfer into the electrolyte on the time of reversed current application was observed, but the loss of Pt from the cathode was higher during the reversed current than during direct current. The use of reversed current intensifies electrolytic Cu refining.

Metalloporphyrins Catalyse the Photo-Reduction of Water to H_2

G. McLENDON and D. S. MILLER, *J. Chem. Soc., Chem. Commun.*, 1980, (11), 533-534

The highly efficient (> 350 turnovers/h) catalytic reduction of water by Zn(II) metalloporphyrins has been observed in a defined "model system" containing Zn porphyrin (10^{-5} M), colloidal Pt (10^{-6} M), methylviologen (10^{-3} M) and ethylenediaminetetraacetic acid on N-phenylglycine (10^{-2} M) and a mechanism is proposed on the basis of the intermediates observed.

Experimental Activation Energies for Oxygen Evolution Reaction on Transition Metal Oxide Electrodes in Acidic Solutions

M. INAI, C. IWAKURA and H. TAMURA, *Denki Kagaku*, 1980, **38**, (3), 173-179

Anodic polarisation curves of transition metal oxides, such as PtO_2 , RuO_2 , Rh_2O_3 , PdO , IrO_2 and $\beta\text{-MnO}_2$ were measured in acidic solution at $10-50^\circ\text{C}$. The activation energies for the O_2 evolution were evaluated. The experimental activation energies on all the studied oxides except Rh_2O_3 and PtO_2 increased linearly with increasing overpotential. The activation energies at equilibrium potential were linearly correlated with the difference of the crystal field stabilisation energies of metal ions between initial and transition states.

Water Photolysis in a Cell with Niobium Oxide Electrodes

D. COSTACHE, *Rev. Chim. (Bucharest)*, 1980, **31**, (4), 345-347

The results obtained from studying the photoelectrochemical effect of a Pt/electrochemical solution/Nb system on water decomposition into O_2 and H_2 are reported. The conditions under which the decomposition is carried out only by sunlight are described. The method of fabricating photoelectrodes from Nb oxide is also described. The photocurrent reaches a maximum value at $\lambda = 2800\text{ nm}$ and the reaction yield is estimated.

Conversion of Carbohydrate into Hydrogen Fuel by a Photocatalytic Process

T. KAWAI and T. SAKATA, *Nature*, 1980, **286**, (5772), 474-476

The irradiation by a 500W Xe lamp of carbohydrates, sugar, starch or cellulose, in the presence of water and strongly oxidising $\text{RuO}_2/\text{TiO}_2/\text{Pt}$ photocatalyst powder leads to the efficient production of H_2 . The $\text{RuO}_2/\text{TiO}_2/\text{Pt}$ can be regarded as a microcell where electron-hole pairs are created which then undergo redox surface reactions with molecules in the solution. The photocatalyst is ~ 100 times more active than TiO_2 alone. This method may also be applied to the decomposition of excrements containing cellulose, protein and fat.

The Overpotential Components on the Palladium Hydrogen Electrode

M. ENYO and T. MAOKA, *J. Electroanal. Chem. Interfacial Electrochem.*, 1980, **108**, (3), 277-292

The Pd hydrogen electrode exhibits characteristic overpotential transients when a polarisation current is applied or switched off. This is due to extensive dissolution of H in Pd. The physical significance of the overpotential components were discussed and shown to be an excellent system for studying the detailed mechanism of the H electrode reaction. Individual affinity values and kinetic parameters of the constituent steps were readily obtainable.

The Anodic Characteristics of Mixed Mn-Pd Oxide Electrodes

M. MORITA, C. IWAKURA and H. TAMURA, *Denki Kagaku*, 1980, **48**, (1), 12-15

The anodic characteristics of mixed Mn-Pd oxide electrodes prepared by thermal decomposition were studied in 3M NaCl. It is shown that Ti-supported electrodes (Ti/MnO_x-PdO_x) have a low catalytic activity for the Cl⁻ evolution reaction, due to their low electrical conductivity, compared to that of Ti/PdO_x electrodes. The catalytic activity was improved by the addition of RuO_x in the mixed Mn-Pd oxide layer. The graphite supported electrodes (G/MnO_x-PdO_x) have high activity and stability superior to those of graphite electrodes.

Oxidation State Changes and Structure of Electrochromic Iridium Oxide Films

J. D. E. McINTYRE, W. F. PECK and S. NAKAHARA, *J. Electrochem. Soc.*, 1980, **127**, (6), 1264-1268

The oxidation state of Ir ions in IrO₂ is changed from III to IV during anodic coloration. Virtually all Ir ions in the film are accessible for electrochemical oxidation and reduction. The mean film density is 20 g/cm³, compared to 11.68 for bulk crystalline IrO₂. The film structure is oxide grains, 0.05-0.1 μm in diameter, surrounded by voids, with a high density of microvoids, 25 Å in diameter. This highly porous structure allows ready electrolyte access to the oxide grains throughout the film, aiding rapid coloration and bleaching (~40 ms).

Ruthenium Dioxide Electrodes as Suitable Anodes for Water Photolysis

M. NEUMANN-SPALLART, K. KALYANASUNDARAM, C. GRÄTZEL and M. GRÄTZEL, *Helv. Chim. Acta*, 1980, **63**, (5), 1111-1118

A cell system was developed in which a photoinduced redox reaction occurred in the cathodic compartment, which was coupled to a RuO₂ anode. The light-induced oxidation of Ru(bipy)₃²⁺ by peroxodisulphate showed that even under diffuse room light irradiation the photopotentials developed at the Pt cathode are sufficient to oxidise water in the anode compartment. The O₂ produced at the RuO₂ electrode bears a stoichiometric relation to the current passed. No change in the RuO₂ electrode was observed during several months of operation.

Solid Phase Photoreduction of Methylviologen Adsorbed on Cellulose

M. KANEKO, J. MOTOYOSHI and A. YAMADA, *Nature*, 1980, **285**, (5765), 468-470

Methylviologen (MV²⁺) adsorbed on solid cellulose in vacuo at 30°C was photoreduced to give MV⁺, the colour of the cellulose changing from white to deep blue. The polysaccharide structure might play an important part as a matrix providing some specific micro-environment for the photoreaction to occur. The reaction was sensitised by tris(bipyridyl)Ru(II) complex Ru(bpy)₃ and EDTA.

ELECTRODEPOSITION AND SURFACE COATINGS

Palladium-Tin Activators for Electroless Plating

A. M. POSKANZER and R. M. GARDNER, *Plat. Surf. Finish.*, 1980, **67**, (4), 38-40

A test to provide a sensitive method to distinguish various types of Pd-Sn activator baths is described. The concentration of dissolved Cu, SnCl₂ and active Pd are compared with performance characteristics during the test, which is designed to accelerate failure due to loss in stability. The results show that a salt-based activator is better than an acid-based solution.

A Study of Activation and Acceleration by Mixed PdCl₂/SnCl₂ Catalysts for Electroless Metal Deposition

T. OSAKA, H. TAKEMATSU and K. NIHEI, *J. Electrochem. Soc.*, 1980, **127**, (5), 1021-1029

Five different compositions of mixed acidic PdCl₂/SnCl₂ catalysts for electroless plating were investigated, and their activity identified. Transmission electron microscopy showed that large colloidal particles are required for high catalytic activities. These colloidal particles consist of a system of Pd and Sn atoms with an interaction such as in Pd-Sn intermediates or alloys. The accelerator (1M NH₄BF₄ or 1:1 HCl) removes Sn(IV) ions and coagulates small particles, thus increasing the activity of low-activity catalysts.

LABORATORY APPARATUS AND TECHNIQUE

Noncatalytic Electrodes for Solid-Electrolyte Oxygen Sensors

D. M. HAALAND, *J. Electrochem. Soc.*, 1980, **127**, (4), 796-804

The development of non-catalytic Pt electrodes for accurately measuring the free O₂ content in non-equilibrium gas mixtures containing O₂ and CH₄, C₂H₆, CO or H₂ is reported. Pb poisoned Pt electrodes produced the least perturbation of the gas mixtures and could measure bulk non-equilibrium O₂

concentrations at temperatures >500 – 550°C but still behaved catalytically at lower temperatures. Thus, poisoned electrodes with the solid-electrolyte O_2 sensor can measure direct surface catalytic activity, and solid-electrolyte O_2 sensors can be used for identifying catalytic mechanisms.

Development of a Probe for Measuring Oxygen Partial Pressures in Glass Melting

T. FREY, H. A. SCHAEFFER and F. G. K. BAUCKE, *Glastech. Ber.*, 1980, **53**, (5), 116–123

A Pt-Rh tube with a gas type seal to a ZrO_2 disc at one end was used as a sealed probe for continuous recording of O_2 activity or partial pressure in a glass melt. The probe has good resistance to thermal shock and good mechanical stability.

HETEROGENEOUS CATALYSIS

The First Standard Ever Devised for Measuring the Active Surface Area of Catalysts

Chem. Eng. (N.Y.), 1980, **87**, (15), 9

ASME are now drawing up a standard for measuring Pt/ Al_2O_3 . The standard focuses on the area where catalytic activity occurs. It will be useful for specifying and buying catalysts, and for determining the cause of loss of catalytic activity. The standard uses hydrogen chemisorption; one hydrogen atom is adsorbed for each atom of the metal present on the surface of the catalyst for Pt and Ni.

Comparative Study of the Hydrogenolysis of Cyclopropane, Cyclobutane and Cyclopentane on Pt/ Al_2O_3

J. BARBIER, P. MARECOT and R. MAUREL, *Nouv. J. Chim.*, 1980, **4**, (6), 385–388

The effect of metal dispersion of Pt/ Al_2O_3 catalysts was investigated for the hydrogenolysis of cyclopropane(1), cyclobutane(2) and cyclopentane(3). The hydrogenolysis of cyclopropane was structure insensitive. Turnover numbers for (2) and (3) increase with increasing particle size and both reactions exhibited exactly the same structure sensitivity.

The Combustion of Methane on Platinum-Alumina Fibre Catalysts. I. Kinetics and Mechanism

D. L. TRIMM and C. W. LAM, *Chem. Eng. Sci.*, 1980, **35**, (5), 1405–1413

The oxidation of CH_4 over Pt catalyst supported on porous and non-porous Al_2O_3 fibre was performed to study a convective-diffusive type catalytic combustion. The reaction kinetics were measured above and below 815K, where a change in the apparent activation energy occurred. Comparison with Langmuir-Hinshelwood models suggests that the mechanism involves the reaction between adsorbed CH_4 and O_2 adsorbed or in the gas phase. Permanent catalyst deactivation occurs due to the sintering of Pt or of Al_2O_3 ; the latter is accelerated in steam.

Transformation of Hydrocarbons in the Presence of Modified Zeolite Catalysts

A. A. SPOZHAKINA, N. I. CHAIROVA and D. M. SHOPOV, *Neftekhimiya*, 1980, **20**, (3), 368–371

Studies of transformation of hydrocarbons in the presence of Pt/zeolite catalysts prepared by saturation of zeolites with $[\text{Pt}(\text{NH}_3)_4]\text{Cl}_2$, modified by 0.1, 1 and 2 wt.% of rare earth metals showed an increase of activity and stability of Pt/CaNaY catalysts modified by Ce and La during isomerisation of olefins. The effect of the modifiers is explained in terms of ionic exchange of cations and by molecular reactions.

Conversion of n-Hexane over Monofunctional Supported and Unsupported PtSn Catalyst

F. M. DAUTZENBERG, J. N. HELLE, P. BILOEN and W. M. H. SACHTLER, *J. Catal.*, 1980, **63**, (1), 119–128

When Pt is alloyed with Sn on non-acidic supports there is a drastic reduction in the rates of reactions producing catalyst poisons, and thus increased stability, during n-hexane conversion. The selectivity change may be caused by an adsorption change due to differences in the number of adjacent Pt atoms needed for the reaction pathways. Above 500°C secondary reactions in the gas phase may become important. Hexatrienes on the catalyst surface might contribute to benzene production and radicals might initiate hydrogenolysis.

Catalysis by Supported Metal Clusters—I

B. C. GATES and J. LIETO, *Chemtech*, March, 1980, 195–199

The structures, reactivities and nature of supported metal cluster catalysts and soluble mononuclear metal complex catalysts are reviewed and the effects of CO ligands are examined. Opportunities that clusters offer in catalysis are discussed. The characterisation of polymer-supported Ir, Ru and RuPt clusters by i.r. spectroscopy is examined and shows their great stability in catalysis, which may be the most important practical advantage of supporting clusters. Various clusters and their ethylene hydrogenation kinetics are listed. Evidence for the cluster framework acting as catalytic sites is reviewed.

Zeolite Supported Metal Oxide Catalysts for the Photoinduced Oxygen Generation from Water

J. M. LEHN, J. P. SAUVAGE and R. ZIESSEL, *Nouv. J. Chim.*, 1980, **4**, (6), 355–358

Various times and temperatures for the deposition of metal oxides (RuO_x , IrO_x , MnO_x and NiCo_2O_x) on Y zeolites yielded catalysts which were tested for the photoinduced generation of O_2 by water oxidation. Zeolite supported Ir and Ru oxides were the most efficient catalysts, especially RuO_x + IrO_x supported on a Y zeolite heated at $200 \pm 5^{\circ}\text{C}$ for 8 days in air. This produced O_2 at a rate of 9.9 ml/h/m mole metal. Temperature and pH effects were investigated.

Catalytic Hydrogenation over Noble Metals

P. N. RYLANDER, *Chem. Eng. Prog.*, 1980, **76**, (6), 46-48

Catalytic hydrogenation for producing organic intermediates over various noble metals is reviewed, mostly for the batch operation method. Factors affecting catalytic performance, such as choice of metal, concentration, support, side reactions which may occur, and the rate of H₂ transport to the surface are examined. The relationship of selectivity to agitation, operating temperature, metal loading, pressure, solvent, etc., are examined in order to find conditions to maximise the product.

HOMOGENEOUS CATALYSIS

Olefin Isomerisation in the Presence of Polymeric Complexes of Palladium(II)

G. P. POTAPOV, V. G. LUKSHA and Z. K. RETUNSKAYA, *Neftekhimiya*, 1980, **20**, (3), 361-364

Studies of the activity of gelatinous PdCl₂ complex catalyst containing polymeric polybutadiene-1,2 ligand with grafted acrylic acid showed catalyst activity during *cis-trans* isomerisation and migration of double bonds in olefins. Activity of gelatinous catalytic systems in the isomerisation reaction of olefins is explained by basic swelling of the systems, improving accessibility of the centres, which are fixed in gel, for the substrate molecules.

Activation of Molecular Hydrogen by Transition Metal Complexes. 3. Hydrogenation of Palladium Phosphinehalogenated Complexes in Amine Media

A. S. BERENBLYUM, A. P. ASEVA, L. I. LAKHMAN, V. P. PETROVSKII and I. I. MOISEEV, *Izv. Akad. Nauk SSSR, Ser. Khim.*, 1980, (6), 1227-1231

Spectroscopic studies of the hydrogenation of [PPh₃PdX]₂ (X = Cl, Br) complexes in amine media showed the autocatalytic character of the reaction of [PPh₃PdCl]₂ with H₂ in aniline and toluidine. The induction period of the reaction increased with the decrease of concentration of the complexes, H₂ pressure and temperature. [(PPh₃)₃(PPh₂)₂Pd₃Cl]Cl was the product of reaction.

Phosphinerhodium Complexes as Homogeneous Catalysts. XI. Decarbonylation of Primary Alcohols Used as Solvents under Conditions of Olefin Hydrogenation; A Side Reaction Leading to Catalyst Deactivation

L. KOLLÁR, S. TORÖS, B. HEIL and L. MARKÓ, *J. Organomet. Chem.*, 1980, **192**, (2), 253-256

During the hydrogenation of olefins in alcoholic solvents catalysed by phosphinerhodium complexes, a H₂ transfer reaction from the alcohols to the olefin took place alongside the main reaction. With primary alcohols the aldehydes formed are decarbonylated

and the in situ catalysts formed from [Rh(diene)Cl]₂ and phosphine are partially converted into Rh(CO)(PR₃)₂Cl type complexes and deactivated.

Sulphur-Tolerant Homogeneous Catalysts for the Water Gas Shift Reaction

A. D. KING, R. B. KING and D. B. YANG, *J. Chem. Soc., Chem. Commun.*, 1980, (11), 529-536

The transition metal carbonyls M(CO)₆ (M = Cr, Mo and W) and M₃(CO)₁₂ (M = Ru and Os), but not Fe(CO)₅, have been found to be active homogeneous catalysts for the water gas shift reaction in the presence of a large excess of sulphide generated by Na₂S dissolved in aqueous methanol.

FUEL CELLS

Surface Area Loss of Platinum Supported on Carbon in Phosphoric Acid Electrolyte

G. A. GRUVER, R. F. PASCOE and H. R. HUNZ, *J. Electrochem. Soc.*, 1980, **127**, (6), 1219-1224

A study to determine surface area loss of Pt/C in a 191°C phosphoric acid fuel cell environment was performed. The surface area initially declined rapidly but remained above 20 m²/g for 20,000 h. A study of the effect of operating potential, TEM studies of electrodes, Pt deposited on a C film and the results of previous studies indicate that crystallite migration and coalescence are the major mode by which Pt surface area is lost.

Cogeneration of Electric Energy and Nitric Oxide

C. G. VAYENAS and R. D. FARR, *Science*, 1980, **208**, (4444), 593-594

A high temperature solid electrolyte fuel cell for producing NO_x while recovering the exothermic energy as electricity was constructed and tested. The fuel cell consists of Y-stabilised Zr tube with thin electrodes of Pt deposited on both surfaces. The outer electrode is exposed to ambient air while NH₃ diluted with He flows continually through the tube. By varying the operation temperature and the ammonia molar flow rate, HNO₃ yields >60% can be obtained with simultaneous electricity production.

CATHODIC PROTECTION

Experience with Precious Metal Anodes in Open Hole Deep Groundbeds

A. C. TONCKE, *Mater. Perform.*, 1980, **19**, (3), 38-40

Six platinised Nb anodes were suspended in high Na, Mg chloride waters in open wells for a year. Current densities ranged from 100-267 A/m² at 28 to 124 A, and 22 to 50 V. High output deep groundbeds were necessary for cathodic protection of the parallel large diameter pipelines. Results indicate that Pt-Nb anodes will be more economical than the graphite or Si-Fe anodes formerly used.

Corrosion Behaviour of Low-Alloyed Chrome Alloys with Cathodic Additions in Sulphuric Acid Solutions

N. D. TOMASHOV, V. I. TREFILOV, G. P. CHERNOVA, A. N. RAKITSKI, N. E. PORYADCHENKO, E. F. SAVRANSKII and E. N. USTINSKII, *Zashch. Met.*, 1980, **16**, (3), 280-286

Corrosion electrochemical behaviour of Cr and low-alloyed Cr alloys with plasticising and cathodic additions of Os, Ru and Ir up to 0.4 wt.% and Re up to 1 wt.% was studied in H₂SO₄ solution. During anodic polarisation in 5-40% H₂SO₄ at 25-90°C, Cr became passive at negative potentials. The addition of 0.1-0.4% Os, Ru, or Ir to Cr results in its transition to a stable passive state with high corrosion stability.

ELECTRICAL AND ELECTRONIC ENGINEERING

Formation of p-n Junctions and Ohmic Contacts at Laser Processed Pt-Si Surface Layers

C. J. DOHERTY, T. E. SEIDEL, H. J. LEAMY and G. K. CELLER, *J. Appl. Phys.*, 1980, **51**, (5), 2718-2721

Pt-Si alloy layers were formed during 130 ns pulsed irradiation of Pt coated Si with light from a Nd:YAG laser. The alloys form via surface melting and resolidification. Laser processing of As in the ion implanted p-type Si resulted in formation of a p-n⁺/Pt-Si structure that showed rectifying electrical behaviour. The structure arose because the As and Pt impurities were zone refined to different extents.

NEW PATENTS

METALS AND ALLOYS

Y-Containing Platinum Group Metal Doped Superalloys

JOHNSON MATTHEY & CO. LTD.

British Appl. 2,033,925 A

Ni-based alloys suitable for use in glass fibre production contain 5-25% Cr, 2-7% Al, 0.5-5% Ti, 0.01-3% Y and/or Sc, and 3-15% of a platinum group metal such as Pt, with Ni balance.

Amorphous Iron-Ruthenium Magnetic Alloy

SONY CORP.

U.S. Patent 4,190,438

An amorphous Fe alloy for the magnetic head of a recording apparatus, having a reduced magnetostriction coefficient, contains 2-20% Ru and 10-30% of P, C, Si, B or Ge.

Gold-Palladium-Chromium Spark Plug Alloy

N.G.K. SPARK PLUG CO. LTD. *U.S. Patent* 4,195,988

An alloy having good heat resistance and resistance

Ion-Implanted Low-Barrier PtSi Schottky-Barrier Diodes

J. B. BINDELL, W. M. MOLLER and E. F. LABUDA, *IEEE Trans. Electron Devices*, 1980, **ED-27**, (2), 420-425

An ion implanted shallow n⁺ layer was used to lower the barrier height of PtSi-n-Si Schottky diodes. Reductions up to 200 mV were achieved with little degradation of the reverse current characteristics. During silicide formation the implanted ions are pushed ahead of the PtSi-Si reaction zone and pile up at the silicide-Si interface, giving more barrier lowering than expected from the ion-implant dose. This gives a range of barrier heights and allows high and low-barrier diodes to be fabricated on the same i.c. by a selective implant masking step.

MEDICAL USES

Antitumour Agents. Synthesis of Novel cis-Palladium Complexes and Their Action on Supercoiled DNA

G. R. NEWKOME, M. ONISHI, W. E. PUCKETT and W. A. DEUTSCH, *J. Am. Chem. Soc.*, 1980, **102**, (13), 4551-4552

The synthesis of a stable cis-organometallic reagent containing two cis σ -Pd-Cu bonds making up a novel [5.5.5] fused-ring system is reported. This has the ability to nick supercoiled DNA at low concentrations. Selected cis Pd organometallics may act in a manner similar to that of known intercalating anti-tumour Pt drugs.

to Pb poisoning, when used as the centre electrode of a spark plug, contains 30-70% Pd, 1-10% Cr and the balance Au.

CHEMICAL COMPOUNDS

Rhodates in Resistance Materials

N.V. PHILIPS' GLOEILAMPENFABRIEKEN

British Appl. 2,032,416 A

BaRh₆O₁₂ is claimed per se as a new material. It has a linear positive temperature coefficient of resistance, TCR, and by combining it with a material of negative TCR, it enables a material with a very low TCR to be produced.

Thallium Rhodate

N.V. PHILIPS' GLOEILAMPENFABRIEKEN

British Appl. 2,032,416 A

A resistance material is formed from a permanent binder, a temporary binder and a rhodate of formula Tl_{1-x}Pb_xRh₂O₄ where 0.5 > x ≥ 0. The rhodate may be mixed with a resistance material having a temperature coefficient of resistance, TCR, of opposite sign, to produce a resistor with a low TCR.