

### Bimetallic Phase Transfer Catalysis

H. ALPER and J.-F. PETRIGNANI, *J. Chem. Soc., Chem. Commun.*, 1983, (20), 1154-1155

$\gamma$ -Keto acids are obtained by the phase transfer catalysed reaction of alkynes with CO and  $\text{CH}_3\text{I}$  in the presence of catalytic amounts of Ru and Co carbonyl complexes. This is the first example of bimetallic phase transfer catalysis where the reaction does not occur with either metal complex alone.

### Homogeneous Catalysts for Carbon Dioxide/Hydrogen Activation Alkyl Formate Production Using Anionic Ruthenium Carbonyl Clusters as Catalysts

D. J. DARENSBOURG, C. OVALLES and M. PALA, *J. Am. Chem. Soc.*, 1983, **105**, (18), 5937-5939

The catalytic hydrocondensation of  $\text{CO}_2$  and  $\text{H}_2$  by  $\text{HRu}_3(\text{CO})_{11}$  or  $\text{HCO}_2\text{Ru}_3(\text{CO})_{10}$  clusters in the presence of methanol to provide methyl formate is reported. At the end of the run the catalyst had changed to  $\text{H}_3\text{Ru}_4(\text{CO})_{12}$  which was slightly more effective at catalysing the production of methyl formate, with a turnover rate of 7.3.

## ELECTRICAL AND ELECTRONIC ENGINEERING

### Gate Controlled Amplifier for Platinum NMR Thermometry

Y. JINZAKI, Y. OKUDA and A. J. IKUSHIMA, *Cryogenics*, 1983, **23**, (6), 321-324

The free induction decay signal of the nuclear spin of Pt was measured for use in thermometry. The maximum value of the spin-spin relaxation time observed in Pt is  $\sim 1\text{ms}^2$ , which becomes shorter if there is inhomogeneity in the static or transient magnetic field. Circuitry for detecting Pt nuclear susceptibility was developed and is described. The system is used for nuclear thermometry  $< 30$  mK.

## NEW PATENTS

### METALS AND ALLOYS

#### Multilayered Amorphous Alloy

TOKYO SHIBAURA DENKI K.K. *European Appl.* 90,973

Multiple layers are produced by feeding a sequence of molten metals or alloys on to the surface of a roll rotating at high speed so that the metal solidifies. In one example one of the layers consists of Pd alloyed with 20% Si. The alloy structures may be used for superconductors, springs and latch relays.

#### Electrical Contact Alloy

YU. F. SHEVAKIN ET AL *U.S. Patent* 4,380,528

A contact alloy of high strength, elasticity and corrosion resistance contains 5-30% Pd, 0.1-0.5% Mg, 0.01-0.5% Al, remainder Ag.

### Stability of Pd/Nb<sub>2</sub>O<sub>3</sub>/Amorphous Hydrogenation Silicon Solar Cells

V. PREMACHANDRAN and S. GUHA, *Solar Cells*, 1983, **9**, (3), 203-208

The stability of Pd/Nb<sub>2</sub>O<sub>3</sub>/amorphous hydrogenated Si solar cells was investigated. Heat treatment in vacuum at 70°C increased the saturation current density and reduced the open-circuit voltage to values close to those for Pd Schottky structures. Further deterioration in the characteristics take place on exposure to H<sub>2</sub>.

### Formation of Nickel and Palladium Silicides by a Short-Pulse Light-Flash and Its Application in the Metallization of Solar Cells

J. T. LUE, *Solid-State Electron.*, 1983, **26**, (8), 787-793

Si-rich compounds not reproducible by conventional furnace annealing can be formed by a short-pulse light flash. Pd is chemically deposited on Si wafers which are then thermally annealed before being Ni plated. A rather stable Pd<sub>2</sub>Si is obtained after sintering the sample near 350°C. The Pd silicide acts as a buffer layer to impede the Ni diffusion. This method of manufacture gives comparable characteristics to those obtained by the Ti-Pd-Ag alloy method.

### Electron Tunneling and Hopping Possibilities in RuO<sub>2</sub> Thick Films

N. C. HALDER, *Electrocomponent Sci. Technol.*, 1983, **11**, (1), 21-34

A proposal that the TCR in thick film resistors arises from the usual particle-to-particle conduction, electron tunnelling and phonon-assisted hopping is suggested. Equations for activation energies are derived for the temperature minimum of the resistance with and without hopping. New equations for TCR are suggested. RuO<sub>2</sub> thick film resistors have been used to test the TCR and activation energy, and the results agree with the evidence.

## ELECTROCHEMISTRY

### Electrolytic Cell Electrodes

IMI MARSTON LTD. *British Appl.* 2,113,718A

A cell such as a hypochlorite cell is operated with one anode consisting of a Ti base coated with platinum group metal and two cathodes made of TiO<sub>x</sub>. One cathode is used while the other is being cleaned by local acid generation.

### Corrosion Protection Anode

ORONZIO DE NORA IMPIANTI ELETTROCHIMICI S.p.A. *European Appl.* 84,875

Platinum group metal-coated valve metal anode elements are used in a new design of linear anode structure for cathodic protection.

### Catalytic Electrodes

DIAMOND SHAMROCK CORP. *European Appl.* 87,185/6  
Electrodes for use in the electrowinning of Zn, Cu or Co are made by impregnating a Ti sponge with a catalytic mixture of TiO<sub>2</sub>, Ru oxide and optionally Pd oxide and fixing the product to a Pb support.

### Modified Electrodes

AJINOMOTO CO. INC. *European Appl.* 88,592  
Electrodes having a wide variety of potential uses consist of an electrically conducting solid, such as Pt, on the surface of which are immobilised a strongly acidic cation exchange resin containing aromatic groups, such as a poly (styrene sulphonic acid) and a N-containing electron mediator such as a viologen or a complex of Os, Ru or Fe with phenanthroline or bipyridine.

### Composite Electrolysis Electrode

ISHIFUKU METAL INDUSTRY CO. LTD. *European Appl.* 90,425  
An electrode with a low overvoltage and high durability is obtained using a conventional body of Ti, which is coated with a layer of porous Pt. The porous layer is permeated with Ru, Ir and/or Pd which is then converted to oxide.

### Electrochemical Vinyl Acetate Production

CELANESE CORP. *U.S. Patent* 4,383,899  
Ethylene and acetic acid are reacted at a Pd anode to give vinyl acetate using a potential of 0.4–1.8 V.

### Photoelectric Cell

MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD. *U.S. Patent* 4,388,385  
A cell is claimed which consists of a transparent electrode, made of Sn oxide or vacuum-deposited Pd, Pt or Au, a solid electrolyte which is AgBr, AgI or a complex salt such as RbAg<sub>4</sub>I<sub>5</sub> and a second electrode capable of forming a charge-transfer complex with halogen, such as a polyvinyl pyridine.

### Hydrogen Diffusion Membranes

KERNFORSCHUNGSANLAGE JULICH G.m.b.H. *German Offens.* 3,149,084/155  
A membrane for separating H<sub>2</sub> from gas mixtures consists of successive layers of a nonporous sheet of a Nb and/or Ta alloy saturated with Ag or Cu, a molten mixture of Li hydride and Li chloride and a layer of Pd-Cu or Pd-Ag alloy.

## ELECTRODEPOSITION AND SURFACE COATINGS

### Polymer Coating Method

NATIONAL RESEARCH DEVELOPMENT CORP. *British Appl.* 2,117,669A  
A new technique is used to produce very thin, highly ordered polymeric films on substrates. The substrates listed include Pt, Au, Ag and superconducting alloys containing platinum group metals.

### Electroless Plating

A/S NESELCO *European Appl.* 87,135  
An improved catalyst which removes the need for pre-etching a plastics substrate prior to electroless plating consists of a finely powdered plastics material such as a styrene-acrylate copolymer, impregnated with an ester surfactant, Sn chloride, Pd chloride.

### Electric Terminals

A.M.P. INC. *European Appl.* 91,209  
Terminals are selectively plated with Pt, Pd, Au, Ag or their alloys as they are wrapped round a mandrel.

### Palladium Electroplating Bath

SIEMENS A.G. *German Offen.* 3,148,788  
Uniform bright deposits are obtained from a bath containing per litre, 10–100 ml phosphoric acid of density 1.71 neutralised with 25% aqueous NH<sub>3</sub> and 5–40g Pd as Pd chloride at pH 6.5–8.5.

### Palladium Electroplating Solution

V. A. KIRILOV AND A. D. KISBYACHUK *Russian Patent* 1,006,549  
Bright deposits are obtained from an electroplating solution containing, per litre, 10–40g Pd chloride, 20–40g ammonium sulphate, 80–160g monoethanolamine (97%), 0.5–1.5g long-chain aliphatic alcohol and 0.3–1g hexamethylenediamine tetraacetic- or diethylenetriamine pentaacetic acid.

## LABORATORY APPARATUS AND TECHNIQUE

### Moisture-Responsive Electrical Element

SHARP K.K. *British Appl.* 2,113,400A  
A moisture-responsive element is a membrane of an organic polymer having a hydrophilic group sandwiched between electrodes of Ru, Pt or Au.

### Electrochemical Chlorine Sensor

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE *British Appl.* 2,117,121A  
The measuring electrode of a sensor is formed from a compound of Ru, Ir, Os, Mo or W which is conductive at room temperature. The preferred compound is RuO<sub>2</sub> and/or RuCl<sub>3</sub>.

### Gas Detection Device

HITACHI LTD. *European Appl.* 84,935  
CO is detected as distinct from H<sub>2</sub> through the absence of a polarisation current in a cell. The cell has electrodes of Pt or Pd in a fluorocarbon binder.

### Membrane Electrode for Non-Ionic Species

UNIVERSITY PATENTS INC. *European Appl.* 85,704  
Non-ionic species in aqueous media, such as glucose in blood, is monitored by a membrane electrode consisting of a polymer matrix containing a water-insoluble salt of the non-ionic species deposited on a conductor such as Pt, Au, Ag or C.

## Measuring Probe

RHEOMETRON A.G.

*European Appl.* 87,425

A measuring probe for inductive magnetic flowmeters consists of a Pt wire electrode around which is sintered a tube of oxide ceramic such as  $\text{Al}_2\text{O}_3$ . Leads are provided on the outside of the tube by means of a conductive ink containing Pt particles.

## Exhaust Gas Oxygen Sensor

HITACHI LTD.

*European Appl.* 89,630

A sensor using the Pt-ZrO<sub>2</sub>-Y<sub>2</sub>O<sub>3</sub> system employs O<sub>2</sub> in the atmosphere to supply an independent control for the measurements.

## Oxygen Sensor

FLINDERS UNIVERSITY OF SOUTH AUSTRALIA

*U.S. Patent* 4,384,934

A device for measuring O<sub>2</sub> partial pressure preferably consists of a disc of ZrO<sub>2</sub> solid electrolyte stabilised with Y oxide and provided on one side with a Pd working electrode and on the other side with a counter-electrode of Pt.

## JOINING

### Bonding Surfaces of Different Character

METZELER KAUSCHUK G.m.b.H.

*European Appl.* 90,200

Difficult surfaces such as silicone rubber and polyurethane plastics may be more readily joined by interposing a metallised shim to which both surfaces can be cemented. Textiles metallised with Pt, Au, Ag or Cu may be used.

## HETEROGENEOUS CATALYSIS

### Alkyl Tertiary Amine Production

MITSUBISHI PETROCHEMICAL CO. LTD.

*British Appl.* 2,113,210A

Tertiary amines may be produced with catalyst reuse by reacting CO, H<sub>2</sub> and a primary or secondary amine in the presence of a Rh and/or Ru catalyst and an alcohol solvent. The alcohol is chosen so that the amine separates from a phase containing the catalyst in water such as Rh chloride.

### Catalyst and Process for Ammonia Oxidation

JOHNSON MATTHEY P.L.C. *British Appl.* 2,114,461A

A typical Haber process catalyst containing Fe which may be derived from magnetite, is promoted with a mixture of La and Ni in a 1 : 4-6 ratio and optionally with Ru, Co or Ce. A typical combination is LaNi<sub>5</sub> with 20% Ru.

### Zeolite Dehydrocyclisation Catalyst

CHEVRON RESEARCH CO. *British Appl.* 2,116,450A

The dehydrocyclisation of acyclic hydrocarbons to aromatics is achieved at a higher conversion rate using a catalyst consisting of an L type zeolite, Ba, Sr or Ca and a Group VIII metal, preferably Pt. Typically 0.1-35% Ba and 0.1-5% Pt are present.

## Platinum Wire Catalysts

ALLOY SURFACES CO. INC.

*British Appl.* 2,117,400 A

Pt wire containing 0.5-5% Al is formed by thermal diffusion of the Al. The Al is then leached out to give a "Raney" structure which is heated at 1800-2300°F for at least one week to give catalytic stability, a longer active life and a surface which fissures less. The Pt may be alloyed with another platinum group metal.

## Oxygenic Compound Production

HOECHST A.G.

*European Appl.* 85,398

Acetic acid, acetaldehyde and ethanol are produced by the reaction of CO and H<sub>2</sub> in the presence of Rh promoted with an element or elements of atomic number 21, 39 and 58-71, such as a lanthanide. The catalyst may be supported. In the examples Rh/SiO<sub>2</sub> is promoted by La, Ce, Y, Ho or Gd.

## Exhaust Catalyst

U.O.P. INC.

*European Appl.* 87,808

A catalyst for the oxidation of exhaust gases from I.C. engines or organic processes consists of a metal substrate such as a Ni-Cr alloy electroplated with 0.1-1% Pt or Pd and 0.1-1% Ce or La.

## Hydrogenation Process

SUMITOMO CHEMICAL CO. LTD. *European Appl.* 87,980

In a process for the selective hydrogenation of specified unsaturated hydrocarbons in mixtures over a fixed bed of Pt-supported catalyst, the H<sub>2</sub> is introduced at more than one point along the length of the reaction vessel.

## Removal of Hydrogen from Gases

CJB DEVELOPMENTS LTD. AND UNIVERSAL MATTHEY PRODUCTS LTD. *European Appl.* 89,183

H<sub>2</sub> is removed from a gas which also contains O<sub>2</sub> by contact in the cold with a catalyst containing 0.25-2.5% Pd on a Sn oxide-Al<sub>2</sub>O<sub>3</sub> support. The process is particularly useful for the removal of H<sub>2</sub> from wet air in enclosed spaces. A third Group VIII metal may also be present in the catalyst.

## Disposable Anaerobic Catalyst

JOHNSON MATTHEY P.L.C.

*European Appl.* 89,830

In a process for reacting traces of O<sub>2</sub> in anaerobic jars with H<sub>2</sub>, a catalyst comprising Pd, Pt, Rh and/or Ir on a porous C support is used. The preferred catalyst is 1.67-2.29% Pd/C fibre cloth. This catalyst does not produce fines and so reduces the likelihood of an explosion in the H<sub>2</sub>/O<sub>2</sub> mixture. The catalyst may be used once and then disposed of.

## Olefin Production from Methanol

BASF A.G.

*European Appl.* 90,232

Olefins have been produced from methanol and/or dimethyl ether in the presence of zeolite catalysts. The olefins are now produced in a multiple stage process where the residual reaction product (after olefin separation) is hydrogenated and cracked to give 2-4C olefins. The hydrogenation of the residue may be catalysed by Pt/ or Pd/Al<sub>2</sub>O<sub>3</sub>.

## Reforming Catalyst

EXXON RESEARCH & ENGINEERING CO.

*U.S. Patent 4,379,076*

A catalyst for hydrocarbon reforming consists of an  $\text{Al}_2\text{O}_3$  carrier impregnated with 0.1–2% Pt, 0.1–2% Ir, 0.01–0.1% Cu, 0.001–3% S and 0.1–2.5% halogen.

## Reactivating Acyloxylation Catalysts

BASF A.G.

*U.S. Patent 4,379,756*

Supported Pd-Cu-Te catalysts used for the acyloxylation of butadiene are reactivated by heating them at 200–900°C in an inert gas such as Ar.

## Hydrogen Peroxide Production

AIR PRODUCTS & CHEMICALS INC.

*U.S. Patent 4,379,778*

Improved reduced catalysts for the combination of  $\text{H}_2$  and  $\text{O}_2$  to give peroxide are obtained when Pd is deposited on a C support and then treated with an aldehyde or ketone and hydrochloric acid.

## Catalysts for I.C.E. Exhaust Systems

GENERAL MOTORS CORP.

*U.S. Patent 4,380,510*

A catalyst for the purification of I.C.E. exhaust is made by modifying a particulate  $\text{Al}_2\text{O}_3$  carrier with one or more base metals, preferably chosen from Ce, La, U, Sn, Ba, Fe, Cu, Co and Ni, and then coating with thin layers of two platinum group metals preferably chosen from Pt, Pd and Rh.

## Dehydrogenation Catalyst

U.O.P. INC.

*U.S. Patent 4,381,257*

A catalyst for the dehydrogenation especially of paraffins or alkyl benzenes consists of an  $\text{Al}_2\text{O}_3$  carrier impregnated with 0.01–2% Pt, 0.05–5% Co, 0.01–5% Ta and 0.1–5% Li or K oxide.

## Shell Boilers

JOHNSON MATTHEY & CO. LTD. *U.S. Patent 4,384,549*

Boilers, especially shell boilers, are provided with a catalyst to bring about the catalytic combustion of at least a proportion of any unburned fuel leaving the combustion chamber. The catalyst is preferably a substrate coated with a layer of refractory metal oxide and then with a platinum group metal or alloy. The use of the catalyst enables the boiler to be run more efficiently and reduces the time needed to clean the pipes of the boiler.

## Hydrogenation Catalyst

EXXON RESEARCH & ENGINEERING CO.

*U.S. Patent 4,387,258*

The selective hydrogenation of alkynes and dienes to alkenes is catalysed by a crystalline  $\text{SiO}_2$  polymorph of specified physical properties impregnated with 0.1–0.5% Pd.

## Oxidation Catalyst

AMERICAN CYANAMID CO.

*U.S. Patent 4,389,386*

A catalyst for the oxidation of HCN to isocyanic acid is Ag crystals coated with 20–10,000 ppm Pd.

## Reforming Catalyst

BASF A.G.

*German Offen. 3,201,457*

A catalyst for the steam reforming of hydrocarbons to olefins consists of a carrier such as  $\text{SiO}_2$ , promoted with Mg oxide, supporting Ru.

## Hydrogenation Catalyst

KAZAKHISKII KHIMIKO-TEKHNOLICHESKII INSTITUT

*Russian Patent 1,004,333*

A catalyst for the hydrogenation of benzene to cyclohexane consists of Rh black promoted with 5–10% of a Sm, La or Eu oxide.

## HOMOGENEOUS CATALYSIS

### Chiral Phosphines for Hydrogenation Reactions

F. HOFFMANN-LA ROCHE & CO. A.G.

*British Appl. 2,114,134 A*

New chiral phosphines are (phosphino)(phosphinomethyl)pyrrolidines with the N atom optionally substituted, such as (2S,4S)-4-(diphenylphosphino)-2-[(diphenylphosphino)methyl]-1-(diphenylphosphinyl)pyrrolidine. Their complexes with Rh are asymmetric hydrogenation catalysts.

### Aromatic Reduction of Cyclohexene

IMPERIAL CHEMICAL INDUSTRIES P.L.C.

*British Appl. 2,114,149 A*

A compound containing a cyclohexene ring is obtained by adding two nucleophiles and then two electrophiles to a dicationic organic Group VIII metal complex. The complex is preferably obtained from Ru, Rh or Ir, such as (hexahaptohexamethylbenzene)(pentahapto pentamethylcyclopentadienyl)ruthenium bis(tetrafluoroborate).

### Ethylene Glycol from Synthesis Gas

TEXACO DEVELOPMENT CORP.

*British Appl. 2,114,562 A*

Ethylene glycol and lower alcohols are produced by contacting CO and  $\text{H}_2$  with a Ru-containing compound, a substituted aromatic compound and a quaternary phosphonium bromide. Typical examples of the catalyst components are  $\text{RuO}_2$  or Ru carbonyl, chlorobenzene or hexamethyl benzene and tetrabutylphosphonium bromide.

### Ethanol and Propanol Production

RUHRCHEMIE A.G.

*European Appl. 84,833*

Ethanol and propanol are produced by the reaction of methanol, CO and  $\text{H}_2$  in a reaction medium containing a Co compound, a Ru compound, an iodide and a phosphine. Ru acetylacetonate is used in some examples with Co carbonyl and NaI.

### Rhodium Complex Catalysts

PLURICHEMIE ANSTALT

*European Appl. 86,046*

In specified homogeneous hydrogenation reactions the catalyst system consists of triphenylphosphine, and a product of the reaction of hydrazine with a Rh complex, preferably  $\text{RhCl}(\text{PPh}_3)_3$ .

## Rhodium Oxo Reaction Catalysts

TOA NENRYO KOGYO K.K. *European Appl.* 89,697

New catalysts for oxo reactions, hydrogenation, isomerisation, etc., have the formula  $\text{HRh}(\text{CO})(\text{XAr}_3)_n(\text{YAr}'_3)_{3-n}$  where X is P and Y is As or Sb, X is As and Y is P or Sb, or X is Sb and Y is P, As or Sb, n is 1 or 2 and Ar and Ar' are aryl groups such as  $\text{HRh}(\text{CO})(\text{AsPh}_3)_2(\text{SbPh}_3)$ .

## Methanol Carbonylation Catalyst

SHELL INTERNATIONALE RESEARCH Mij. B.V.

*European Appl.* 90,443

The reaction of methanol with CO in the presence of  $\text{CH}_3\text{I}$  and NaI to give acetic acid and/or methyl acetate is catalysed by Pd acetate and an amine ligand such as bipyridine or tetramethyl ethylenediamine.

## Epoxide Polymerisation Catalysts

SHELL INTERNATIONALE RESEARCH Mij. B.V.

*European Appls.* 90,444/45

Catalysts for epoxide polymerisation are complexes of general formula  $\text{M}_2[\text{M}'(\text{CN})_6\text{X}_6]_d \cdot w\text{M}''\text{X}'_e \cdot x\text{H}_2\text{O} \cdot y\text{L} \cdot z\text{H}_n\text{X}''_m$ , where M' and M'' may each be Ir, Rh or Ru, among others.

## Catalytic Reduction of Nitroaromatics

MONTEDISON S.p.A.

*European Appl.* 91,383

A nitroaromatic compound is reduced by the transfer of H from an alcohol in the presence of an Ir catalyst formed by an Ir salt chelated with an olefin or diene and a nitrogenous ligand such as an ethylene and dipyridyl complex of IrCl.

## Aldehyde Ethers

DAVY MCKEE (OIL & CHEMICALS) LTD.

*U.S. Patent* 4,383,125

Aldehyde ethers useful in organic synthesis are obtained by hydroformylating the corresponding allyl ethers in the presence of a Rh catalyst such as  $\text{HRh}(\text{CO})(\text{PPh}_3)_3$ .

## Hydroformylation Catalyst

OCCIDENTAL RESEARCH CORP. *U.S. Patent* 4,386,013

A catalyst for olefin hydroformylation consists of a Rh compound or complex, such as  $\text{Rh}(\text{CO})\text{Cl}(\text{PPh}_3)_2$ , intercalated on a carrier which is a layered Zr phosphonate complex such as  $(\text{EtPO}_3)_4\text{Zr}_3[\text{O}_3\text{P}(\text{CH}_2)_3\text{PPH}_2]_2$ .

## Ester Production Catalysts

E. I. DU PONT DE NEMOURS & CO. *U.S. Patent* 4,386,217

The formation of esters from olefins, alcohols, CO and  $\text{O}_2$  is catalysed by a system consisting of a heteropolyacid and a Pd compound or complex, preferably bis (benzonitrile)Pd dichloride.

## Water Gas Reaction Catalysts

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (CNRS) *French Appl.* 2,515,064

New water soluble catalysts are complexes of Rh, Ir or Co with a modified phenanthroline or bipyridine.

## FUEL CELLS

### Platinum Alloy Catalysts

UNITED TECHNOLOGIES CORP.

*British Appl.* 2,117,791 A

The performance of Pt and other noble metal catalysts in reactions where the reduction of O is a rate limiting step is improved by increasing the electron density of states at the Fermi level of the catalyst. This may be achieved by alloying with suitable metals such as W, V, Mo, Co and Cr. The catalysts are useful for fuel cells and other purposes such as I.C.E. exhaust gas purification.

### Fuel Cell with Catalyst/Oxidiser Electrode

HITACHI LTD.

*European Appl.* 90,358

Water-repellent particles and platinum group metal particles are supported on one side of an ion exchange membrane to provide an oxidiser electrode while other platinum group metal particles are placed on the opposite side of the membrane to form the fuel electrode, giving a three-phase system.

### Fuel Cell Catalytic Electrode for Metals Recovery

EXXON RESEARCH & ENGINEERING CO.

*U.S. Patent* 4,385,970

Platinum group metals, Cu, Ag and Hg may be recovered from acidic solutions in a cell in which the cathode is an electrically conductive porous substrate coated on its exterior surface with a fuel activating catalyst and fed with  $\text{H}_2$  in the absence of any externally applied potential. The catalyst is preferably Rh, Pt, Pd or Ir or an alloy or mixture of these metals.

## CHEMICAL TECHNOLOGY

### Platinum Metal Compounds in Photographic Materials

KONISHIROKU PHOTO INDUSTRY CO. LTD.

*European Appl.* 91,788

Ag halide photographic materials are given improved gradation characteristics by adding, based on 100g Ag, at least 40 mg of a water soluble Group VIII compound having a molecular weight of at least 100. Typical compounds are Na, K and ammonium chloropalladates, chloroiridates and chloroplatinates and  $\text{RhCl}_3$ .

## ELECTRICAL AND ELECTRONIC ENGINEERING

### Magnetic Regenerative Wheel

U.S. DEPARTMENT OF ENERGY

*British Appl.* 2,113,371 A

Cooling over a large temperature range is achieved using a wheel with layers of ferromagnetic or paramagnetic porous material arranged according to their Curie temperature. The preferred materials are gadolinium intermetallics, some with platinum group metals, such as  $\text{Gd}_3\text{Pd}_2$ .

### Electron Tube Cathode Composition

HITACHI LTD. *British Appl.* 2,116,356 A

An impregnated cathode capable of operation at lower temperatures consists of Os, Ru, Ir, W, Mo, Ta or Re powder mixed with Sc oxide and/or a mixed oxide containing Sc such as (Sc, Y)<sub>2</sub>O<sub>3</sub>. The emissive impregnant is Ba oxide.

### Ruthenium Dioxide Resistors

CORNING GLASS WORKS *European Appl.* 86,077

Frits which can be readily applied to Al<sub>2</sub>O<sub>3</sub> to give films with a temperature coefficient of resistance of less than 100ppm are based on 32-39% PbO, 44-47% B<sub>2</sub>O<sub>3</sub>, 14-17% SiO<sub>2</sub> and up to 5% WO<sub>3</sub> or MoO<sub>3</sub>. These frits are used with RuO<sub>2</sub> and a vehicle to give inks for resistor production.

### Thin Film Magnet

HITACHI LTD. *European Appl.* 87,559

A thin film permanent magnet is made by sputtering from a Co alloy containing 5-35 at.% Pt.

### Electric Contact

SIEMENS A.G. *European Appl.* 88,220

A non-sticking contact of low contact resistance consists of a ferromagnetic substrate tipped with Ag coated with a 0.2-2µm film of Rh.

### Electrographic Method of Circuit Board Production

EASTMAN KODAK CO. *European Appl.* 89,221

A toner containing a chemical plating catalyst in its particles is used to produce a conductive circuit on a board by photocopying. The toner particles are fused and then reinforced by chemical plating. Platinum group metals and Au are among the catalysts which may be used.

### Improved Liquid Connector

JOHNSON MATTHEY P.L.C. *European Appl.* 89,829

An electrical connection using a liquid conductive material, especially for use in glass fibre spinning, is designed to reduce stress between the parts. In a glass fibre spinning machine the bushing and the lug connecting it to a source of heating current may be made from platinum group metals, Ag, Au, Cu, Al or an alloy thereof. This improved electrical connector has a reduced tendency for the liquid conductive material to be expelled.

### Information Storage

THOMSON-C.S.F. *European Appl.* 89,874

In an optical disc for information storage the sensitive layer is protected from the effects of atmospheric humidity by a transparent flexible barrier layer which is a thin film of Pt, Pd, Au or alloy thereof.

### Integrated Circuits

BURROUGHS CORP. *U.S. Patent* 4,381,215

A method for forming electrical contacts to semiconductor chips includes the provision of successive layers of Pt silicide, a barrier metal preferably Ti-W and a conductor preferably Al.

### Thick Film Conductor

E.I. DU PONT DE NEMOURS & CO. *U.S. Patent* 4,381,945

The adhesion of a thick film conductor printing composition containing 30-80% finely divided Pd, Ag and optionally Pt, 1-20% Pb-Ge glass and 0.1-10% of a metal oxide capable of reacting with Al<sub>2</sub>O<sub>3</sub> to form a spinel is improved by incorporating a hydrolysible Ti complex such as the acetylacetonate.

### MOS Field Effect Transistor

TEXAS INSTRUMENTS INC. *U.S. Patent* 4,384,301

The transistor has enhanced oxide thickness at the edge of the gate electrode, and Pt silicide regions in the gate electrode, and source and drain areas to improve the breakdown voltage in multilevel interconnect devices.

### Semiconductor Devices

BELL TELEPHONE LABORATORIES INC. *U.S. Patent* 4,388,383

In semiconductor devices based on InP, GaP or InGaAsP carrier recombination is suppressed by providing the surfaces with a monolayer or less of Rh, Au or Ag.

### Printed Circuit Boards

ROBERT BOSCH G.m.b.H. *German Offen.* 3,145,584

A conductive paste is applied to the surface of through-holes in printed circuit boards by means of an elastically deformable die. The board may be of ceramic or enamelled steel printed with a Ag-Pd paste and baked at 800-900°C, or a plastics substrate printed with a Ag paste and baked at 150-250°C.

### Modified Titanium Dioxide

M. B. BORISOV ET AL. *Russian Patent* 996,391

The ease of metallising a TiO<sub>2</sub> ceramic, such as for condensers, is improved by incorporating 0.001-0.01% Sn and 0.01-0.05% Pd.

## MEDICAL USES

### Eyeless Suture Needle

M. SEISAKUSHO *British Appl.* 2,113,588 A

The blunt end of a needle blank made of oxidation resistant material is pierced with a heat resisting tool after it has been heated to near its melting point. Os and Ru may be used to produce the tool.

### Pacemaker Electrode

W. C. HERAEUS G.m.b.H. *European Appl.* 85,743

In a specified cardiac pacemaker electrode, the lead consists of sintered particles of an Ir alloy such as 90% Pt-10% Ir.

### Dental Alloy

DEGUSSA A.G. *U.S. Patent* 4,382,909

A Au free dental alloy is claimed which contains 1-70% Pd, 0.1-35% Cr, 0.2-1% B, remainder Co. Alternative compositions may also contain minor amounts of other metals, such as lanthanide metals.