

# NEW PATENTS

## ELECTROCHEMISTRY

### Amorphous Alloy for Electrodes

JAPAN SCI. & TECHNOLOGY CORP.

*European Appl.* 801,151A

An electrode material for anode electrolysis uses a platinum group metal based amorphous alloy of composition  $NM_{100-ab}Ni_aCu_bPt_c$ , where NM is at least one metal selected from Pd and Pt, with 1–30% Pt; a, b, and c are atomic % so that  $a+b = 30-45$ ,  $b/a = 3-7$  and  $c = 18-25$ . A temperature width  $\Delta T_x$  of the electrode material in a supercooled liquid region is  $\geq 70$  K, and  $\Delta T_x = T_x - T_g$ , where  $T_x$  and  $T_g$  are the crystallisation and glass transition temperatures.

### Photocatalyst for Photoreactions

PETROLEUM ENERGY CENT. *World Appl.* 97/26,991A

A photocatalyst comprises  $TiO_2$  implanted with Cr, V, Cu, Fe, Mg, Ag, Pd, Ni, Mn and/or Pt ions below the oxide surface in the amount of  $1 \times 10^{15}$  ions/g of oxide. The presence of metal ions extends the range of light absorption into the visible, so that reactions can be catalysed by UV to visible light irradiation. The catalyst is used for photoreactions, such as butene isomerisation and nitrogen oxide decomposition.

### Electrode for Chloralkali Cell

DOW CHEM. CO.

*U.S. Patent* 5,645,930

An electrode has a substrate with a porous heterogeneous catalytically active primary phase coating, with a substantial internal surface area having a Pt group metal matrix mixed with a particulate material; a secondary intermediate coating of an adhesion promoting polymer and an electroless metal plating catalyst; and an outer phase metal reinforcing coating. The coatings impart durability to the electrode which has low  $H_2$  overpotential and is more poison-resistant.

### Electrochemical Device

DAIICHI DENKO K.K.

*Japanese Appl.* 9/155,157

An electrochemical device comprises an anode made of a Pt-plated conductive porous base material for generating  $O_2$  by  $H_2O$  electrolysis, a cathode consuming  $O_2$  by the generation of  $H_2$ , and a solid polymer electrolyte membrane working as a proton exchange membrane. This electrolyte contains fine catalyst particles and is filled in the pores of the base material. This device is used for  $O_2$  enrichment, deoxygenation devices or humidifying elements.

### Electrode for Electrolysis

TDK CORP.

*Japanese Appl.* 9/157,879

An electrode for electrolysis has a substrate underlying containing Ta and a covering layer containing Ir, Ta and Si oxides, provided through the underlying layer on the substrate. Production of the electrode by pyrolysing the underlying and covering layers is also claimed. The electrode has stability, a prolonged life and superior durability. It is used to electrolyse an electrolyte containing at least one organic compound.

### Electrode Film Junction Body

TANAKA KIKINZOKU KOGYO K.K.

*Japanese Appls.* 9/165,689–90

An electrode film junction body for electrolysis is produced by ion exchange absorbing Pt ions to a cationic exchange resin film and depositing a Pt metal layer on the surface of the film using a reducing agent. The Pt ion source is a complex salt consisting of a Pt amine complex ion and a hydroxide ion. The process removes Cl ions to depress HCl generation, a by-product, so promoting a stable exchange reaction. The quality of the Pt-film junction body is maintained.

## ELECTRODEPOSITION AND SURFACE COATINGS

### Platinum Coatings

U.S. SEC. OF ARMY

*U.S. Patent* 5,650,202

A uniform Pt coating is formed on a non-conductive substrate, such as a glass slide or Si wafer, by immersing the substrate with hydrophobic C black in  $H_2PtCl_6$  and HCHO to reduce the acid and form metallic Pt on the surface. Hydrophobic pretreatment of C black powder with a  $CF_4$  gas plasma is also claimed. This method is simple, effective and inexpensive, and is used in making mirrors for lasers, protective coatings, in corrosion prevention and electroless plating on non-conductive substrates.

### Plating of Iridium

YAZAKI CORP.

*Japanese Appl.* 9/13,190

Novel Ir plating is carried out using a plating bath containing  $SeO_3^{2-}$  ions. It is used for plating Ir layers with excellent adherence on electronic components.

### Thin Platinum Film

MITSUBISHI MATERIALS CORP.

*Japanese Appl.* 9/157,851

A raw material, for forming a thin Pt film by metal organic chemical vapour deposition, is obtained by mixing (1,5-dimethyl-1,5-cyclooctadienyl)Pt with an electron donating compound. It has superior pyrolysis and a very high deposition rate. The Pt film is produced with high efficiency and purity. Thin Pt films can be formed on an underlying electrode for a dielectric substance used in memory semiconductor devices.

### Coating Liquid

SUMITOMO METAL MINING CO.

*Japanese Appl.* 9/161,561

A coating liquid (1) used to form dark-colour transparent conductive films is a dispersion of conductive oxide fine particles, which contain Ru oxide, Ir oxide, or Ru- or Ir-based pyrochroa of  $\leq 50$  nm in diameter, in a polar solvent. The conductive films are formed by coating (1) on a substrate and coating over with a solution containing the polymer of partially hydrolysed alkyl silicate, followed by firing at  $< 400^\circ C$ .

## APPARATUS AND TECHNIQUE

### NOx Sensor

NGK INSULATORS LTD. *European Appl.* 791,825A

A device to measure NOx in the exhaust from petrol or diesel engines includes a main pumping cell to control the partial pressure of O<sub>2</sub> and electrodes contacting the process gas, with at least one comprising a platinum group metal containing 0.01–1% Au. This Au-Pt alloy has a low activity towards NOx, which allows elimination of O<sub>2</sub> so that NOx can be measured with high stability and accuracy.

### Selective Detection of Carbon Monoxide

KURABE K.K. *Japanese Appl.* 9/113,501

A material for the selective detection of CO gas contains WO<sub>3</sub>, MoO<sub>3</sub> and a Pt group metal catalyst which gives a reversible yellow colour change. CO is selectively detected in atmospheres containing mixtures of CO gas and ethanol.

### Solid Electrolytic Oxygen Pump

MITSUBISHI JUKOGYO K.K. *Japanese Appl.* 9/127,051

A solid electrolytic O<sub>2</sub> pump has an oxygen ion conductive material used as a partition wall with a noble metal electrode on each surface and a Pt electrode collecting net. The Pt nets simultaneously decrease electrode material resistance and electrode reaction resistance. The pump has superior O<sub>2</sub> partial pressure controllability. The O<sub>2</sub> concentration in N<sub>2</sub> or Ar is very low, with O<sub>2</sub> partial pressure of 10<sup>-14</sup> atm. The pump is used in producing semiconductors, in controlling O<sub>2</sub> strength in alloying processes, heat treatment, inert gas production or anaerobic atmosphere control in fermentation or microorganism culture.

## HETEROGENEOUS CATALYSIS

### Reduction of NOx in Diesel Engine Exhaust

BASF A.G. *European Appl.* 779,093A

A catalyst for the reduction of NOx in diesel engine exhaust gas comprises a spinel of formula Ca<sub>a</sub>Zn<sub>b</sub>Al<sub>c</sub>O<sub>4</sub>, mixed with Pd, Pt, Rh, Ru, Os, Ir or Re and/or rare earth, such as Ln, Ce, V, Ti, Nb, Mo, W and/or their salts; where a + b + c = 3 and a > 0, b > 0 and c > 0. The spinel is preferably impregnated with CeO<sub>2</sub> in an amount of 0.5–15 wt.%, especially 1–8 wt.%. The catalyst has high stability and effectively purifies exhaust gases.

### Non-Selective Oxidation Catalyst

INST. FRANCAIS DU PETROLE

*European Appl.* 780,156A

A non-selective oxidation catalyst comprises a monolithic substrate, an inorganic refractory porous support, and an active phase containing Ce, Zr, Fe and at least one metal selected from Pd and Pt. The Pd and/or Pt content is > 3 g l<sup>-1</sup> of the catalyst and the porous support is 200–400 g l<sup>-1</sup> of the catalyst. This catalyst is used for the catalytic combustion of fuels, such as HC, CO, H<sub>2</sub> and their mixtures, and especially natural gas, for automotive exhaust gas de-pollution.

### Reduction Purification of NOx

COSMO OIL CO. LTD.

*European Appl.* 781,592A

The reduction purification of a NOx-containing exhaust gas involves contacting the gas with a catalyst in an oxidative atmosphere containing excess O<sub>2</sub> and in the presence of at least one reducing agent selected from a hydrocarbon and an O<sub>2</sub>-containing organic compound. The catalyst comprises Sn, and Ru, Pd, Rh and/or In. The process effectively reduces NOx in the presence of excess O<sub>2</sub> and in a gas containing H<sub>2</sub>O vapour or SO<sub>2</sub>.

### Staged Fuel Injection

INST. FRANCAIS DU PETROLE

*European Appl.* 784,188A

A staged fuel injection catalytic combustion process comprises a catalytic zone containing a catalyst made of a monolithic substrate, a porous refractory inorganic oxide-based support and an active phase consisting of (based on weight of porous support) 0.3–20% Ce, 0.01–3.5% Fe and 0–20% Zr together with Pd and/or Pt in an amount of > 3, preferably 5–15 g l<sup>-1</sup> of the catalyst. It is used for catalytic combustion in radiant panels and tubes, catalytic stoves, gas turbines, etc. The process has high stability during operation and start-up and provides improved performance, especially in the catalytic combustion of methane, CO, H<sub>2</sub> and their mixtures.

### I.C.E. Exhaust Gas Treatment

FORD MOTOR CO.

*European Appl.* 785,017A

A catalyst system for the conversion of hydrocarbons, CO and NOx in exhaust gas from an I.C.E. comprises first, second and third catalyst bricks consisting of a porous substrate and a metallic catalyst arranged in series in the exhaust gas passage downstream of the manifold. The first brick, coated with Pd, has the smallest volume, and is closely coupled to the exhaust gas manifold and is positioned adjacent to and spaced apart from the second catalyst by ≤ 10 inches. The system provides good conversion even at cold-start and has high temperature durability.

### Catalytic Converter System

FORD MOTOR CO.

*European Appl.* 786,284A

A closely coupled catalytic converter system exhibiting rapid light-off and low start-up emissions has two catalytic elements. The first has a thermally stable washcoated substrate with > 100 g ft<sup>-3</sup> of large particle Pd deposits and is closely coupled to the exhaust manifold of an I.C.E. The second is a washcoated substrate with deposited metals efficient at reducing HC, CO and/or NOx emissions from an exhaust gas stream with higher O<sub>2</sub> capacity than the first element.

### Selective Hydrogenation of Diolefins

PHILLIPS PETROLEUM CO. *European Appl.* 792,685A

A catalyst for the selective hydrogenation of 3–12C diolefins comprising Pd metal and/or Pd oxides, at least one alkali metal iodide, and at least one inorganic support is prepared by impregnating and heating in a non-oxidising gas at 300–600°C. The catalyst has a high activity, selectivity and catalyst life.

## Emission Control from Gasoline Engine

ICT CO. LTD.

*World Appl.* 97/20,619A

Emissions from a fuel direct injection type gasoline engine are controlled using an exhaust purifying catalyst containing a Pt group metal, such as Pt, and transition metals. The purification of exhaust gas with a wide variation in the composition and temperature, resulting from frequent change of the air:fuel ratio, can be simplified.

## Hydrodechlorination Catalyst

AKZO NOBEL N.V.

*World Appl.* 97/20,629A

The durability of a supported Group VIII metal hydrodechlorination catalyst is improved by treatment with a non-elemental halide compound, such as a chlorohydrocarbon or an alkali(ne earth) metal chloride, but which is not a mineral acid. A preferred catalyst is Pt or Pd on an oxide support, and the metal, in the zero valent state, mainly resides at the surface and is visible under a microscope having a resolution of  $\sim 5 \text{ \AA}$ .

## Hydrogenation Catalysts

IMPERIAL CHEM. IND. PLC

*World Appl.* 97/25,142A

Hydrogenation catalysts comprise supported Pd and an alkali metal. They are used for the hydrogenation of halofluorocarbons and hydrohalofluorocarbons to produce hydrofluoroalkanes for use as CFC replacements in refrigeration and air conditioning. Product selectivities of  $> 95\%$  are obtained.

## Production of Mono-olefins

UNIV. MINNESOTA

*World Appl.* 97/26,987A

The production of mono-olefins, used as gasoline octane improving components, from gaseous 2C+ paraffin hydrocarbons is reported. This involves reacting the hydrocarbons and  $O_2$  in the presence of a highly active and selective Pt catalyst modified with Sn and/or Cu and supported on a ceramic monolith.

## Improved Diesel Trap Performance

CLEAN DIESEL TECHNOL. INC.

*World Appl.* 97/28,358A

The operation of a diesel engine equipped with a diesel trap is improved by combusting the fuel-air mixture and introducing at least half of a Pt group metal directly into the exhaust gases, with a combustible organic liquid, to partially load the diesel trap for more effective regeneration. The Pt group metal is present at 0.05–1.0 ppm as an alcoholate, sulfonate, etc., to reduce the balance point temperature. At least half of an auxiliary metal composition, selected from Ca, Mg, Mn, etc., is introduced into the fuel prior to combustion.

## Hydrogen Peroxide Production

ERIK BENGTTSSON PROCESS DESIGN

*World Appl.* 97/32,811A

$H_2$  and  $O_2$  are contacted in the presence of a Pd or Pt supported catalyst in a hydroquinone solvent (I) which has no  $H_2O$  phase and a limited solubility for the  $H_2O_2$  product and  $H_2O$ . (I) can also contain  $H_2SO_4$  or  $H_3PO_4$  to improve the yield and reaction velocity.  $H_2O_2$ , used in cellulose bleaching, is formed at 50% concentration and  $\leq 95\%$  yield.

## Colloidal Palladium-Gold Alloy Catalyst

HOECHST CELANESE CORP.

*World Appl.* 97/33,690A

A colloidal Pd-Au supported catalyst for the selective production of vinyl acetate from ethylene, acetic acid and  $O_2$  is produced by forming an aqueous solution of  $H_2O$ -soluble Pd and Au compounds, dispersing the solution in a hydrophobic solvent to form a microemulsion which is treated with a reducing agent, impregnating a support with the mixture, and drying. A uniform microstructure of Pd and Au on the support is achieved by reduction of the metals before impregnation. The catalyst has improved selectivity over an extended time span.

## Catalytic Hydrogenolysis

E. I. DU PONT DE NEMOURS & CO.

*U.S. Patent* 5,629,462

The catalytic hydrogenolysis of fluorohalo(hydro)carbon(s) is achieved at 125–350°C using a hydrohalogenation catalyst prepared by impregnating a C support (with an ash content of  $< 0.2 \text{ wt.}\%$ ) with 5–95 wt.% Au, and 95–5 wt.% of Ru, Rh, Pd, Os, Ir and/or Pt, and heating at  $\leq 350^\circ\text{C}$  to dry the composition and reduce the metals. For the hydrogenolysis of 2,2-dichloro-1,1,1,2-tetrafluoroethane, a selectivity of 97.7% and conversion of 33.4% were obtained.

## Supported Palladium Catalyst

LEVER BROS. CO. DIV. CONOPCO INC.

*U.S. Patent* 5,643,849

A catalyst consisting of Pd and Bi on a C support is prepared by suspending 1–10 wt.% Pd (on a C support) and 0.1–10 wt.% Bi in  $H_2O$  at a Pd:Bi ratio of 6:1–6:2; and adding 5–15% (by wt. of the catalyst support on C) of an aldehyde. The catalyst is used for the oxidation of an aldose to a salt of aldonic acid. It gives high selectivity, high oxidation rates and a low coloured product. Conversions of lactose to Na lactobionate of 99.7% can be achieved.

## Alkane/Cycloalkane Isomerisation Catalyst

PHILLIPS PETROLEUM CO.

*U.S. Patent* 5,654,254

A Group VIII catalyst containing Cl is prepared by impregnating at least one of Pt, Pd and Ni, and  $Al_2O_3$  as the support, with at least one organoaluminium chloride, heating the material obtained in an inert gas and treating with a hydrogen chloride-containing gas at 630–750°C. The catalyst is used in alkane/cycloalkane isomerisation. It has high activity which is maintained for long periods.

## Catalytic Partial Oxidation of Hydrocarbon

UNIV. MINNESOTA

*U.S. Patent* 5,654,491

The catalytic partial oxidation of a hydrocarbon, for a rapid and effective production of oxygenate(s), comprises passing a feed gas mixture containing  $O_2$  and a hydrocarbon with at least one normal 2–4C alkane, such as butane, through a Group VIII metal (preferably Rh and Pt) catalyst gauze structure of  $\geq 80\%$  transparency. The exit gas mixture comprises CO and  $CO_2$  with a total C selectivity of  $\leq 70 \text{ molecule}\%$  C. Liquid fuels and chemicals from lower alkanes associated with remote sources of natural gas are obtained.

## Production of 3-Chloropropyltrichlorosilane

SHINETSU CHEM. IND. CO. LTD.

*Japanese Appl.* 9/192,494

A catalyst for the production of 3-chloropropyltrichlorosilane (CPTCS) from allylchloride and trichlorosilane comprises a tertiary amine, such as quinoline, and a colloidal Pt catalyst. The amount of tertiary amine is preferably 0.1–5.5 equivalents with respect to 1 mol of Pt. Allylchloride reduction, a side reaction, is suppressed, so CPTCS is obtained in high yield. It is used as a silane coupling agent.

## High Octane Aviation Benzine

LENGD. LENNEFTKHM. RES. PRODN. ASSOC.

*Russian Patent* 1,438,228

High octane aviation benzine is produced by the catalytic reforming of an atmospheric benzine fraction, at 440–470°C and elevated pressure, in the presence of a catalyst containing Pt, Cl and Al<sub>2</sub>O<sub>3</sub>. The catalyst additionally contains a synthetic erionite zeolite (I), at a ratio (in wt.%): Pt 0.1–1.0, Cl: 0.1–1.0, (I) 10–50 with the balance Al<sub>2</sub>O<sub>3</sub>. The method improves the quality of the product and simplifies technology.

## Catalyst for Removing Organic Compounds

VORONEZHSHINTEZKAUCHUK STOCK CO.

*Russian Patent* 2,072,898

An aluminosilicate carrier in the form of spherical granules is impregnated with a 0.8–2.5 g l<sup>-1</sup> solution of chloroplatinic acid or Pd chloride at a ratio of solution to carrier of 0.6–0.8:1 by volume, to an absorption level of ≤ 100%. The catalyst is then sulfided with H<sub>2</sub>S and dried. The catalyst has a high mechanical strength, high thermal stability and increased activity, and gives 99–99.55% removal of organics and oxidation products from industrial waste gases.

## Preparation of $\gamma$ -Butyrolactone

BEIJING CHEM. IND. INST. MIN.

*Chinese Patent* 1,111,167

A catalyst comprises Cu, Zn and Al oxides as a matrix with a surface coating of Pd or Pt. The unreduced catalyst matrix comprises (in wt.%): 20–65 CuO, 20–55 ZnO and 5–30 Al<sub>2</sub>O<sub>3</sub>, and the ratio of Pd or Pt to the matrix is 0.005–0.1. The catalyst size is 5 mm in diameter and 5 mm in length. When used at 280°C, 1 atm and a H<sub>2</sub>:anhydride molar ratio of 40, the catalyst gives 100% conversion of *cis*-butandioic anhydride to give  $\gamma$ -butyrolactone in 92.7% yield.

## HOMOGENEOUS CATALYSIS

### Preparation of Hydrogen Peroxide

ENICHEM S.p.A.

*European Appl.* 788,998A

H<sub>2</sub>O<sub>2</sub> is prepared from CO, O<sub>2</sub> and H<sub>2</sub>O in the presence of a soluble Pd acetate catalyst, an arsine or phosphine ligand and H<sub>2</sub>SO<sub>4</sub> in an organic solvent, preferably chlorobenzene, such that the solubility of H<sub>2</sub>O in the solvent is 0.025–0.035%. The process is carried out in cycles with the ligand regenerated and recycled into the reaction. The use of H<sub>2</sub> is avoided and yields are improved by the solvent.

## Pentenoic Acid Preparation

E. I. DU PONT DE NEMOURS & CO.

*World Appl.* 97/29,069A

Pentenoic acid or a pentenoate ester, used in preparation of nylon, etc., is produced by contacting a mixture of pentenoic acid chloride, chlorobutene and a Pd catalyst with H<sub>2</sub>O or alcohol. The molar ratio of H<sub>2</sub>O or alcohol : pentenoic acid chloride is < 1.2 and that of chlorobutene : Pd > 10 during a major part of the preparation. Decomposition of the Pd catalyst is avoided and the relatively stable end products can be separated from the reaction mixture by distillation. Almost no reaction of chlorobutene with H<sub>2</sub>O or alcohol to an undesired by-product occurs.

## Carbonylation Catalyst

DAICEL CHEM. IND. LTD. *Japanese Appl.* 9/173,860

A catalyst for the carbonylation of acetylene or unsaturated olefins, to give (un)saturated organic carboxylate, contains a Pt source, organic phosphine and an organic carboxylic acid. This catalyst has a higher stability, giving higher conversion and yield in liquid phase reactions, for example 99.2% of propylene was converted to methyl methacrylate in 92.0% yield.

## Preparation of $\beta,\gamma$ -Unsaturated Compounds

MIYUCUBISHI CHEM. CORP. *Japanese Appl.* 9/176,051

The preparation of  $\beta,\gamma$ -unsaturated compounds (1) with a skeletal structure derived from a massive conjugated alkadiene, comprises reacting a conjugated alkadiene with an active H-containing compound using a Pd compound and a trivalent P compound. (1) are obtained in high yield and selectivity and are used for plasticisers or aromatics, or are easily converted to olefins for co-monomers.

## FUEL CELLS

### Gas Permeable Electrode

AUTOMOBILES CITROEN S.A.

*European Appl.* 788,174A

A gas permeable electrode for membrane fuel cells is produced by pre-impregnating C with a solution of Pt anions or cations, mixing with an ionomer solution and reducing the Pt electrochemically by mounting the electrode as a cathode and conducting electrolysis with an aqueous electrolyte. The electrodes have in situ Pt deposits, where Pt/Pt+C > 20% for a thickness of 10–20  $\mu$ m with a homogeneous particle size of 2–5 nm, and a percentage of Pt in contact with the ionomer and the C of the order of 100%.

### Selective Oxidiser for Fuel Cell Power Plant

INT. FUEL CELLS CORP.

*World Appl.* 97/25,752A

An assembly, for selectively oxidising hydrocarbon fuel gas and converting CO in a reformed fuel gas to CO<sub>2</sub>, has a gas flow section with Pt catalyst coated passages joined by a common wall to a section containing coolant passages. The flat construction allows the heat exchange per unit volume of the catalyst in intimate contact with the heat exchange surface to be increased so that the volume of the oxidiser can be reduced.

## Electrical Interconnect Device

CERAMIC FUEL CELLS LTD. *World Appl.* 97/35,349A

An electrical interconnect device for planar solid oxide fuel cells has a plate-like Cr-containing substrate with fuel gas-flow channels on one side and an oxidation-resistant coating on the sides which contact the anode. The outer O<sub>2</sub> barrier layer of the coating is 0.5–100 µm thick and comprises one or more of Ni, Pt, Pd, Au, Ir, Rh and Ru, especially Ni or Pt or their alloys. An electrically conductive metal barrier layer 0.5–100 µm thick comprising Nb, Ta, Ag or their alloys lies between the substrate and the outer layer. The planar fuel cell assembly is also claimed.

## Fuel Cell

CALIFORNIA INST. OF TECHNOLOG.

*U.S. Patent* 5,656,388

A fuel cell has an electrolyte, a fuel electrocatalysing anode and an O<sub>2</sub> electrocatalysing cathode of a ternary metal alloy, AB<sub>x</sub>X<sub>3</sub>, where A is one or more rare earth metals; B is one or more of Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Mn, Cd, Hg and Al; X is at least one element E selected so that at least one binary alloy AE or BE has an enthalpy of formation greater than that of the binary alloy La-Sn; and  $y \geq 0$ . The cathode alloy in hydride form has a good structural integrity and H<sub>2</sub> capacity.

## Phosphoric Acid Electrolytic Fuel Cell

FUJI ELECTRIC CO. LTD. *Japanese Appl.* 9/134,728

A fuel cell, for fuel and air electrodes, comprises a porous matrix, impregnated with phosphoric acid and placed between layers of acetylene black supporting a Pt catalyst containing PTFE binder. The mixing ratio by wt. of PTFE : C is 0.2–0.8. The lifetime of the cell is increased by suppressing the transfer of phosphoric acid to the fuel electrode.

## ELECTRICAL AND ELECTRONIC ENGINEERING

### Multichip or Hybrid Circuit Module

DIEHL G.M.B.H & CO. *European Appl.* 795,902A

This module has a multilayer ceramic substrate on which the dies are positioned with wire bonds at sites with Bi or Ag-Pd metallisation. There is an electrically conductive adhesive layer under each die to which a heating current is injected from a DC or AC power source by a pair of probes in a slotted manipulator. This allows reworking without thermal stress.

### Grain Oriented Recording Media

DENSITEX CORP. *World Appl.* 97/31,370A

A grain oriented multilayer perpendicular recording medium has layers of common grain structure alternating between a magnetic Co alloy layer < 50 Å thick and a thinner noble metal layer, which includes at least one of Pd and Pt,  $\geq 2.2$  Å in thickness. The overall atomic concentration of Co is in the range 60–95% and includes a non-homogeneously dispersed magnetic element. Archival data can be stored with a very small distance between adjacent magnetic transitions.

## Formation of Platinum Silicide Plugs

L. G. SEMICON. CO. LTD. *U.S. Patent* 5,645,887

A PtSi plug is produced by forming an insulating layer on a Si substrate, which has a conductive layer on part of it, patterning to form a contact hole and exposing the conductive layer to air to form a native oxide film. A poly-Si film is formed on the native oxide to completely fill the hole and etched back to expose the insulating layer, forming a plug in the contact hole. A Pt layer is formed on the Si plug and the insulating layer is heat treated to convert the plug into PtSi. The remaining Pt is removed. This method is used to form contact plugs of high aspect ratio in LSI devices.

## Permanent Magnetic Film

NEC CORP.

*Japanese Appl.* 9/63,020

A permanent magnetic film on a magnetoresistive head has a closed packed structure of 8–25 wt.% Co-Cr-Pt alloy, with the Cr-Pt composition being 9–12 wt.%. It is very corrosion proof, and has increased resistance to organic solvent, peeling liquid and developing/etching solution. It stabilises the vertical magnetic field, improves the symmetry of the reproduced waveform and avoids the Barkhausen noise effect.

## Ferroelectric Memory Using Platinum Film

OKI ELECTRIC IND. CO. LTD. *Japanese Appl.* 9/64,300

A ferroelectric memory has a lower electrode comprising a Pt film and an electrically conductive oxide film with a perovskite structure on which a ferroelectric film and an upper electrode are sequentially formed. This prevents deterioration of the crystal state of the ferroelectric film and greatly improves its efficiency.

## Magnetic Recording Medium

KAO CORP.

*Japanese Appl.* 9/69,441

A magnetic recording medium has an amorphous C substrate and a magnetic layer at the surface of the substrate consisting of 6–11% Cr, 6–10% Pt, 4–10% B, and the remainder is Co. A high holding force is obtained that corresponds to a high density recording.

## Printed Circuit Structure

S. SERIZAWA

*Japanese Appl.* 9/172,237

A printed circuit structure includes Pd-Ni plated on a Cu foil or a Cu plating, formed as a top layer on a foundation layer made of resin ceramics or an alloy, over which Au plating is formed by electroless substitution. The structure offers superior bonding capability, inhibits diffusion and is heatproof.

## Piezoelectric Element

MATSUSHITA DENKI SANGYO K.K.

*Japanese Appl.* 9/181,369

The manufacture of a reduced size piezoelectric element involves forming a Pt layer 0.1 µm thick on a 80 µm thick polyimide film. A 100 mJ s cm<sup>-2</sup> pulse UV laser beam is irradiated onto the Pt layer at room temperature to form a PbTiO<sub>3</sub> thin film on the Pt layer.

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