

Chemical Vapor Deposition of Ruthenium

M. E. GROSS, L. E. PAPA, M. L. GREEN and K. J. SCHNOES, *Extended Abstracts*, **84-1**, Spring Meeting, Cincinnati, Ohio, May 6-11, 1984, Abstract No. 101, 149-150

A low temperature organometallic chemical vapour deposition process for Ru is described. Three organometallic Ru compounds were tested as sources for chemical deposition of the metal on Si and SiO₂ substrates at low temperature and pressure. The decomposition of Ru₃(CO)₁₂ in vacuum produced the most uniform metallic films. During runs at temperatures 250-450°C, the film thickness and grain sizes decreased. Resistivity values of the Ru films increased with increasing deposition temperature. Samples deposited at 250-300°C compare favourably with pure Ru. Ru from Ru₃(CO)₁₂ deposited on a device wafer at 300°C gave excellent conformal step coverage. This Ru was subsequently oxidised to RuO₂.

NEW PATENTS

METALS AND ALLOYS

Silver-Plastic Moulded Body

JOHNSON MATTHEY P.L.C. *U.S. Patent* 4,410,475

Articles such as jewellery may be fabricated by moulding under pressure and at elevated temperature a mixture of metallic particles and thermoplastic particles. The metals may be platinum group metals, Au, Ag and base metals such as Ni, Cu, Zn or Sn.

Amorphous Magnetic Alloy

T.D.K. ELECTRONICS CO. LTD. *U.S. Patent* 4,416,709

An alloy highly resistant to corrosion for use in the core of a magnetic head has a composition of formula (Fe_pCo_qNi_r)_aM_bCr_cM'_dX_e where M is Ru alone or a mixture with Pt, Pd, Ir and/or Rh, M' is a transition metal other than those in the formula, X is a vitrification element, p + q + r = 100%, a + b + c + d + e = 100% and e is 20-26%. A typical alloy is (Fe_{5.6}Co_{94.4})_{70.4}Ru₂Cr(Si₁₀B₉₀)_{23.5}O_{.5}Ti.

CHEMICAL COMPOUNDS

Amorphous Zirconium Phosphosilicate

DAIICHI KIGENSO KAGAKU KOGYO CO. LTD.

European Appl. 105,128

New ion exchange agents of increased resistance have the formula Zr(PO₄)_{2y}(SiO₂)_z.n'H₂O or M_{2l}Zr(PO₄)_{2y}(SiO₂)_z.n'H₂O where l is the valence of the cation M, y is 0.02-2, z is 0.05-16.00 and n' is 0-100. The cation may be derived from Groups IA, IB, IIA, IIB, IIA, IIIB, VA, VIA, VIIA and VIII. Platinum group metals, Ag and the lanthanides are among the cations proposed.

ELECTRICAL AND ELECTRONIC ENGINEERING

A Hydrogen Sensitive Pd-MOS Structure Working over a Wide Pressure Range

H. M. DANNETUN, L.-G. PETERSSON, D. SÖDERBERG and I. LUNDSTRÖM, *Appl. Surf. Sci.*, 1984, **17**, (3), 259-264

A Pd-MOS structure, made of p-doped Si wafer, thermally oxidised to an oxide thickness ~100nm, with Pd evaporated to a thickness of ~100nm, has been developed. It is sensitive to H₂ both in air at atmospheric pressures and in UHV. It is sensitive to H₂ pressure from 5 × 10⁻¹¹ to 2 Torr. It has applications in studying catalytic reactions involving H on metal surfaces, leak detection on underground telephone cables and water tubing, and monitoring H in breath for medical diagnosis. Under different experimental conditions the H pressure range could be extended by at least two orders of magnitude.

Palladium and Platinum Sulphur Complexes

ADW DER D.D.R.

East German Patent 203,054

Complexes L₂M, where L is a dithiobenzil, are made by reacting a HCl acid solution of the metal with a corresponding diketone or acyloin and P pentasulphide. M is Pt, Pd, or Ni.

ELECTROCHEMISTRY

Electrolytic Cell Electrodes

ENERGY CONVERSION DEVICES INC.

European Appl. 99,866/67

An improved anode or cathode is formed by a transition metal host matrix incorporating one or more modifier elements, such as Ru co-sputtered with Ti or material with the composition Ni₃₁Co₆₅Ru₄.

Electrocatalytic Energy Conversion

MASSACHUSETTS INSTITUTE OF TECHNOLOGY AND W.R. GRACE & CO.

European Appl. 99,894

Electrochemical reactions for energy and chemical production give improved yields when carried out in a solid-state cross-flow monolith reactor. The monolith may be made from yttria-stabilised ZrO₂ with screen printed Pt electrodes.

Water Photolysis Cell

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

European Appl. 100,695

In a new form of cell the separate O₂ formation and H₂ formation catalysts are held apart by depositing them on different supports. The cell may use a Ru bipyridyl photosensitiser and the catalysts are usually platinum group metal or Ag.

Electrodes for Brine Electrolysis

OLIN CORP. *U.S. Patent 4,409,085*
Reticulate cathodes for use in brine electrolysis are felts of plastics filaments coated with an electroconductive metal such as Ni, Mo, Co or a platinum group metal or alloy. The corresponding anodes are preferably of Ti mesh coated with Ru oxide.

Electrolytic Ozone Production

BBC BROWN BOVERI & CO. *U.S. Patent 4,416,747*
Water saturated with O₂ is used to produce O₃ in a cell where the electrolyte is solid. The electrolyte, such as a membrane, is coated on the cathode side with Pt and on the anode side with PbO₂.

Raney Alloy Coated Cathode

OLIN CORP. *U.S. Patent 4,419,208*
A low overvoltage electrode for use as a H₂ evolution cathode in an electrolytic cell has a conductive metal core with a Raney metal surface layer derived from an adherent (Ni-Ru)Al₃ beta-phase alloy containing 5-15% Ru.

Polarographic Electrode

PHOTOVOLT CORP. *U.S. Patent 4,419,210*
A membrane electrode for polarography comprises an auxiliary electrode preferably of pure Ag, a working electrode, preferably made of a noble metal such as Pt and a reference electrode, such as a Ag/AgCl electrode.

ELECTRODEPOSITION AND SURFACE COATINGS

Palladium Electroplating

TECHNIC INC. *U.S. Patent 4,406,755*
Bright coatings free from microcracks are obtained from electroplating baths containing succinimide, pyridine or a pyridine derivative and an organopalladium complex such as PdL₂SO₄ where L is preferably ethylene diamine or propane-1,3-diamine.

Palladium Electroplating

DEGUSSA A.G. *U.S. Patent 4,411,743*
Good quality Pd coatings are obtained from an electroplating bath which is not corrosive to the substrate metal. The bath contains, per litre, 2-50g Pd of which 80-95% is present as sulphate and the remainder as sulphite, 40-100g H₂SO₄ and/or phosphoric acid and no HNO₃ acid.

Palladium-Nickel Alloy Plating

LANGBEIN-PFANHAUSER WERKE A.G. *U.S. Patents 4,416,740/41*
Baths containing 5-30 g/l Pd, 5-30 g/l Ni and a Pd:Ni ratio of 30-90:70-10 are known to give alloy coatings able to replace Au. Their brightness and mechanical properties are now improved by

using an acetylene imine or aminoalcohol brightener. The *U.S. Patent 4,416,741* describes the use of acetylene alcohols and/or their ethers as brighteners.

Black or Blue Rhodium Electrodeposits

NIPPON MINING CO. LTD. and NIPPON METAL PLATING CO. LTD. *U.S. Patent 4,416,742*
Electroplated coatings with a black or blue colour are obtained using a conventional Rh plating bath with an added organic carboxylic acid, aromatic sulphonic acid, amine, gelatin, butynediol and/or a hypophosphite, such as ethylenediamine.

LABORATORY APPARATUS AND TECHNIQUE

Catalytic Gas Detector

J. & S. SIEGER LTD. *British Appl. 2,125,554A*
A sensing element for a catalytic flammable-gas detector has an electrically resistive heating element, such as a Pt or Pt alloy coil, embedded in a bead having a Pd, Pt, Rh or Ir catalyst dispersed over particles of a metal oxide support material prior to formation of the bead.

Hydrogen Isotopes Separation

KERNFORSCHUNGSZENTRUM KARLSRUHE G.m.b.H. *British Appl. 2,126,204A*
Apparatus for separating the gaseous H isotopes protium, deuterium and tritium from a gas stream uses a membrane, such as a Pd membrane, which is permeable to the H isotopes and impermeable to the gas stream.

Vapour Source-Holding Container

KONISHIROKU PHOTO INDUSTRY CO. LTD. *British Appl. 2,127,315A*
A low emissivity wall material used in the construction of a vapour source-holding container may be of mirror-ground Pt or Au. The container is for an evaporative material such as Se-Te, Se-S, Fe-Ni or AgBr-I.

Blood Gas Sensors

DIAMOND SHAMROCK CORP. *European Appl. 100,667*
A new solid state transcutaneous blood gas sensor is constructed from a noble metal electrode (Ag or a platinum group metal), a Ag/Ag halide reference electrode and an O₂-permeable polymeric membrane electrolyte.

Carbon Monoxide Gas Detector

TOKYO SHIBAURA DENKI K.K. *European Appl. 102,067*
A gas detector for CO consists of a gas sensor and a reference sensor. The gas sensor is based on Sn oxide or another oxide semiconductor whose resistance changes on contact with the reducing gas, a pair of electrodes, of Pt-Au, and a layer of Pt, Pd or Rh deposited on an Al₂O₃, SiO₂ or ZrO₂ support. The reference sensor electrode is similar, except that the catalyst is Ag.

Thermal Flow Meter

HITACHI LTD. *European Appl.* 103,212
The current flowing through a Pt or other thermosensitive element is amplified and the signal processed to indicate the required parameter for the fuel intake required.

Determining Hydrogen Flux through Membrane

HELLESENS A/S *European Appl.* 103,588
Steel components are susceptible to H₂ attack in corrosive environments. The extent of such attacks on steel is now measured electrochemically on a steel member, coated with a Pd film, using the Devanathan principle.

Oxygen Sensor

NISSAN MOTOR CO. LTD. *U.S. Patent* 4,419,213
For installation in a vehicle exhaust system, an O₂ sensing element has a solid electrolyte concentration cell formed as a laminate of thin layers on a ceramic substrate in which a heater is embedded and to which lead wires are attached. A conductive cermet paste prepared by dispersing a mixture of 65 parts Pt powder and 5 parts of a ZrO₂-yttria powder (95 : 5 mole ratio) in 30 parts of an organic liquid vehicle may be used in its production.

JOINING

Ductile Brazing Alloy

G.T.E. PRODUCTS CORP. *European Appl.* 104,623
An alloy for brazing ceramics, other non-metals and metals contains 0.25–5% of Ti, V and/or Zr, 25–85% Au and/or Pd and 15–70% Cu and/or Ni. The noble metal gives ductility to the alloy. Cr may also be optionally present in small amounts.

Brazing Foil

ALLIED CORP. *U.S. Patent* 4,405,391
An homogeneous, ductile foil, useful for brazing Fe, Ni and Co alloys, contains 1–41 at.% Pd, 0–20 at.% Cr, 11–20 at.% B, remainder Ni.

Brazing Alloy

GENERAL ELECTRIC CO. *U.S. Patent* 4,414,178
An improved brazing alloy, particularly suitable for use in high temperature gas turbine engines, consists of 20–80% Pd, 2–13% Cr, 1–4% B, remainder Ni.

HETEROGENEOUS CATALYSIS

Lead Tolerant Catalyst Containing Ceria

JOHNSON MATTHEY P.L.C. *British Appl.* 2,122,912A
A Pb-tolerant spark-ignition engine exhaust gas purification catalyst comprises Pt, Ru and/or Pd on ceria which is supported as a refractory oxide coated support. The combination of the Pt, Rh and/or Pd with ceria results in improved Pb tolerance.

Diesel Engine

JOHNSON MATTHEY P.L.C. *British Appl.* 2,122,914A
Particles in diesel engine exhaust gas are oxidised using an interstitial catalyst system comprising a catalyst such as Pt, Rh, Pd or their alloys, a layer of refractory metal oxide and a support comprising filamentary metallic material in a knitted or woven form. The gas is made to execute a sharp change in direction.

Methanol Production

BRITISH PETROLEUM CO. P.L.C. *British Appl.* 2,125,400A
Methanol is produced by passing CO and H₂ over a supported Pd metal catalyst containing a Group IA metal, Group IIA metal or lanthanide element as promoter and supported on a C support with defined surface area characteristics.

Heat Recovery Process

BABCOCK & WILCOX CO. *European Appl.* 99,658
Waste gases from a combustion process, such as a boiler, are passed through a recovery heat-exchanger which has a catalyst-coated surface to oxidise the combustion products and increase heat recovery. The catalyst may be Pt, Pd or Ni deposited on the surface by sputtering.

I.C. Engine Exhaust Gas Treatment

STE. FRANCAISE DES PRODUITS POUR CATALYSE PRO-CATALYSE *European Appl.* 100,267
A multimetal catalyst is produced from Al₂O₃ or another support by several treatment stages: the impregnation with Pd and at least one base metal (includes lanthanide metals), activation, impregnation with a platinum group metal other than Pd and finally reduction. In one example Pd is used with Fe and Ce.

Olefin Hydroxylation Catalyst

EXXON RESEARCH & ENGINEERING CO. *European Appl.* 102,154
Olefins are hydroxylated with a water/oxidant mixture in the presence of a supported Os catalyst, such as Os₃(CO)₁₂ on MgO, optionally together with NaI. Typically isobutylene glycol is produced using this type of catalyst.

Nitrilotriacetone Production

MONSANTO CO. *European Appl.* 102,343
A gas stream containing HCN is produced, by reacting NH₃ and a hydrocarbon on a Pt-Rh gauze, and is scrubbed out of the gas stream with nitrilotriacetone mother liquor. The liquor is fed to a unit for the production of nitrilotriacetone.

Hydrogen Peroxide Production

EKA A.B. *European Appl.* 102,934
A new form of catalyst for the well known anthraquinone process consists of one or more thin-walled coherent solid catalyst bodies forming parallel channels through which the working solution and H₂

pass. The platinum group metal catalyst preferably forms a thin layer on the walls.

Metallisation of Polyarylene Sulphide Printed Circuit Boards

PHILLIPS PETROLEUM CO. *European Appl.* 103,149

The adhesion of conductive metals to polyarylene sulphide surfaces after pretreatment with a Pd-Sn catalyst is increased by allowing the metallised board to age.

Multimetal Hydrocarbon Reforming Catalyst

MOBIL OIL CORP. *European Appl.* 103,449

A new catalyst contains 0.05–5% each of Pt, Ir and Re uniformly dispersed throughout a porous refractory oxide support, instead of being deposited on the surface as before.

I.C. Engine Exhaust Catalyst

AIR PRODUCTS & CHEMICALS INC.

U.S. Patent 4,407,738

A specified single step impregnation method is used to impregnate a carrier consisting of Al_2O_3 spheres containing minor amounts of La oxide, Nd oxide and Ce oxide with Pd, Pt and Rh so as to obtain a desired distribution of the metals in the carrier particles.

Catalyst Packaging

DEGUSSA A.G.

U.S. Patent 4,409,185

Pyrophoric Fe or Ni catalysts which may emit H_2 during storage or transport are packed in containers having a safety closure which is a hollow stopper provided with a relief valve and containing a recombination catalyst such as Pt and/or Pd supported on Al_2O_3 .

I.C. Engine Exhaust-Gas Purification

UOP INC.

U.S. Patent 4,410,454

A catalyst for the oxidative purification of I.C.E. exhaust gases consists of a metallic support such as a Ni-Cr alloy electroplated with a mixture of platinum group and lanthanide metals, preferably Pd and Pt, and La or Ce.

Selective Hydrogenation Catalyst

IMPERIAL CHEMICAL INDUSTRIES P.L.C.

U.S. Patent 4,410,455

A catalyst for the selective hydrogenation of acetylenic impurities in an olefin stream to olefins is made by calcining shaped pieces of a Ca aluminate cement at 900–1050°C and impregnating with a Pd salt solution below pH 1.3.

Diesel Oil Production

GULF RESEARCH & DEVELOPMENT CO.

U.S. Patent 4,413,064

A catalyst for the conversion of synthesis gas to diesel oil is made by impregnating Al_2O_3 with an aqueous solution of a Co salt and a mixture of Th or La nitrate and Ru acetylacetonate in an organic solvent such as acetone-ethanol.

Osmium Hydroxylation Catalysts

EXXON RESEARCH & ENGINEERING CO.

U.S. Patent 4,413,151

The hydroxylation of olefins to diols is catalysed by an Os carbonyl cluster complex supported on a carrier such as Al_2O_3 , with NaI co-catalyst.

Oxidation Catalyst

TOKYO SHIBAURA DENKI K.K. *U.S. Patent* 4,414,139

A catalyst for the oxidation of CO, especially in the waste gases from domestic cookers or heaters, is made by calcining a Li aluminosilicate clay, coating with Al_2O_3 , and impregnating the Al_2O_3 coating with a platinum group metal, preferably Pt.

Naphtha Hydroreforming

EXXON RESEARCH & ENGINEERING CO.

U.S. Patent 4,415,441

In a process for producing a high-octane hydrocarbon from naphtha and H_2 over a supported Re-promoted Pt catalyst, the H_2 is at first added at no more than 75% of the rate required to maintain an optimum yield of hydrocarbons with over five C atoms.

Internal Coating of Tubes with Catalyst

DEGUSSA A.G.

U.S. Patent 4,415,485

An internal coating of catalyst is provided on contact tubes in a simplified mechanised way by filling the inside of the tube with catalyst liquid and heating the surface of the liquid as it is drained from the tube. In an example an Al_2O_3 tube is filled with a Pt solution which was heated to 250°C as it was drained at a rate of 8cm/minute.

Effluent Gas Purification

RICOH CO. LTD.

U.S. Patent 4,415,533

Malodorous exhaust gas from an electrophotographic machine is purified by passing it over a heated porous honeycomb oxidation catalyst in which the active material may be Pd or Pt, among others.

Catalytic Combustor

UNITED TECHNOLOGIES CORP. *U.S. Patent* 4,415,537

A catalytic combustor for use with solid-fuel stoves consists of a carrier which is stable at high temperatures, such as La-stabilised Al_2O_3 , supporting an active, S-tolerant catalyst such as Rh.

Syngas Catalyst

SHELL OIL CO.

U.S. Patents 4,415,675/76

A catalyst for the conversion of synthesis gas to paraffins, alcohols and aldehydes is made by calcining a Ru-exchanged faujasite zeolite in N_2 and then in H_2 , treating with a borane solution and again calcining successively in N_2 and H_2 .

Homologation Catalyst

ETHYL CORP.

U.S. Patent 4,415,749

A catalyst for the formation of ethanol and methyl acetate from methanol and synthesis gas consists of 1–10% Rh and 1–10% Fe supported on Al_2O_3 modified with Na or Ca.

Nitrobenzene Hydrogenation

E. I. DU PONT DE NEMOURS & CO.

U.S. Patent 4,415,754

Crude nitrobenzene is hydrogenated over a Pd-Pt-Fe/C catalyst, and aniline is separated from the tarry residue.

Hydrocarbon Conversion Catalyst

UOP INC.

U.S. Patent 4,416,804

A variety of conversion processes, particularly gasoline fraction reforming, are catalysed by an acidic multimetal composite containing 0.01–2% Pt or another platinum group metal, 0.05–5% Co, 0.01–5% Sn, 0.01–5% P and 0.1–3.5% halogen.

Oxidation Apparatus

DAIKIN KOGYO K.K.

U.S. Patent 4,418,046

In a process for the catalytic oxidation of CO, formaldehyde and/or methanol, a cylindrical honeycomb catalyst carrier is designed so that it can be regenerated in sections by the passage of hot air. The active component is finely divided Pd.

Oxygen Scavenging System for Anaerobiosis

BECTON DICKINSON CORP.

U.S. Patent 4,419,451

A system for producing an atmosphere for culturing anaerobic microorganisms comprises, in a sealable container, a metal-metal salt couple (a) capable of reacting with O₂ and a catalyst for the reaction of O₂ with gas generated in the container. In (a) the metal salt may contain Pt or Pd and the catalyst may be a supported Pd catalyst.

Hydrodesulphurisation Catalyst

INSTITUT FRANCAIS DU PETROLE

French Appl. 2,521,448

If a natural gas stream, possibly containing small amounts of O₂ and odourised with tetrahydrothiophene, is to be used as a chemical feedstock, the S compound should first be removed to prevent catalyst poisoning. This is done by mixing the gas with H₂ at elevated temperature and passing the mixture over a 0.1–5% Pd catalyst supported on Al₂O₃ or SiO₂.

Ruthenium Catalyst

INSTITUT FRANCAIS DU PETROLE

French Appl. 2,523,955

A catalyst for the production of CH₄ from CO_x and H₂ in aqueous media is obtained by impregnating a vegetable carbon of high specific surface area with Ru acetylacetonate and reducing it in a stream of H₂.

Three-Way Catalyst

DEGUSSA A.G.

German Offen. 3,223,500

A three-way catalyst for the purification of I.C.E. exhaust gases consists of a carrier which is particulate Al₂O₃ or a ceramic honeycomb coated with Al₂O₃ impregnated with Ce oxide or a mixture of Ce oxide and Fe oxide in the ratio Ce : Fe of 9 : 2 to 1 : 8, and the ratio Pd : Rh of 2–20 : 1.

HOMOGENEOUS CATALYSIS

Carboxylic Acid and Ester Co-Production

SHELL INTERNATIONALE RESEARCH MIJ. B.V.

British Appl. 2,123,404A

Carboxylic acid and related carboxylic esters are produced simultaneously by the reaction of different carboxylic esters with CO and H₂ at elevated temperature and pressure using a catalyst system containing a Ru compound, a Group VIII metal compound and an organic bromide or iodide. Other Group II metal and transition metal salts must be absent. Thus ethyl acetate and acetic acid may be produced from methyl acetate in the presence of Rh and Ru chlorides and CH₃I.

Alcohol Production from Synthesis Gas

BRITISH PETROLEUM CO. P.L.C.

European Appl. 100,607

Saturated straight-chain alcohols are produced from synthesis gas using a catalyst, especially a mixed oxide catalyst, containing Co, one or more of Cu, Ag, Ga, Zr, Zn and Th; one or more of Pt, Pd and Ni and one or more Group IA metals, in specified ratios. A typical catalyst is CuCoPd_{0.05}K_xO_y where x is about 1.5% and y satisfies the valence requirements.

Acetic Acid Production Catalyst

CHEMISCHE WERKE HULS A.G. *European Appl. 105,132*

Acetic acid is produced by the rearrangement of methyl formate in the presence of a catalyst consisting of Rh, Rh salt or a Rh complex (but specifically excluding Group VA ligands), a Group VIB metal compound, (preferably Cr carbonyl and/or halide) and a halogen promoter such as CH₃I. At least 0.05mg atom, preferably 0.1–1mg atom, of Rh is used per mol of methyl formate.

Hydroformylation Catalyst

SUN TECH. INC.

U.S. Patent 4,405,496

The hydroformylation of propylene to n.butyraldehyde is catalysed by the complex Pt(acac)₂.5(SnCl₂.2H₂O).5(PPh₃).

Rhodium Complex Catalysts

MONSANTO CO.

U.S. Patent 4,405,814

The hydroformylation of formaldehyde to glycol aldehyde is catalysed by Rh-tertiary phosphine complexes, such as (CO)ClRh(PPh₃)₂ and a t.amine.

Rhodium Complex Catalyst

NATIONAL DISTILLERS & CHEMICAL CORP.

U.S. Patent 4,405,821

The hydroformylation of formaldehyde in liquid organic media to glycol aldehyde is catalysed by ClRh(PPh₃)₃ and Bu₃PO.

Platinum Complex Catalyst

SHELL OIL CO.

U.S. Patent 4,408,078

The hydroformylation of olefins to aldehydes is catalysed by complexes of the type {(PPh₃)₂PtH(OPPh₂)}

Hydrogenation Catalysts

SHELL OIL CO. *U.S. Patent 4,409,397*

Specified asymmetric hydrogenation reactions are preferably catalysed by a system consisting of a complex $(LRhCl)_2$ where L is cyclooctadiene or norbornadiene and a chiral ferrocenyl phosphine ligand.

Rhodium and Ruthenium Catalysts

NATIONAL DISTILLERS & CHEMICAL CORP.
U.S. Patent 4,413,146

Catalysts for the water-gas shift reaction and various organic hydrogenation and hydroformylation reactions consist of a lamellar material such as graphite, a clay or Zr dihydrogen phosphate intercalated with a Rh or Ru carbonyl cluster complex.

Rhodium and Iridium Hydrosilylation Catalysts

MINNESOTA MINING & MANUFACTURING CO.
U.S. Patent 4,414,376

The hydrosilylation curing of vinyl siloxane polymers is catalysed by complexes $(L)MX(L')_2$ or $(L)RhX(CO)_2$ where L is a N heterocycle such as pyridine, phenazine or pyrazine, L' is CO or L'2 is cyclooctadiene and M is Ir or Rh.

Hydrogen Transfer Catalysts

MONTEDISON S.p.A. *U.S. Patent 4,414,417*

H transfer between alcohols and unsaturated ketones is catalysed by complexes of formula $M(L)(cod)X$ where M is Ir or Rh and L is a phenanthroline or bipyridyl ligand. Mainly Ir complexes are used.

Binder for Solid Fuels

UNITED TECHNOLOGIES CORP. *U.S. Patent 4,416,710*
Norbornene polymerised using a Ru chloride catalyst provides a useful binder for gasoline and other liquids to give solid fuels.

Toluic Acid Production

E. I. DU PONT DE NEMOURS & CO.
U.S. Patent 4,416,801

The oxidative carbonylation of toluene with CO and O₂ to toluic acid is catalysed by a mixture of 1.5–95 mol % platinum group metal and perfluorinated polymeric sulphonic acid or its salts (5–98.5 mol %). The two components may be combined, in Pd-exchanged Nafion resin. The text discloses a wider range of S oxyacids as co-catalysts.

Hydrosilylation Catalysts

TH. GOLDSCHMIDT A.G. *U.S. Patent 4,417,068*

The hydrosilylation of compounds containing olefinic double bonds is catalysed by compounds of general formula $M(NH_3)_2X_2$, where X is Cl, Br, I or NO₂ and M is Pd or Pt.

Hydrocarbon Processing

MOBIL OIL CORP. *U.S. Patent 4,417,973*

Hydrocarbon stocks of high olefin content are upgraded by sequential hydroformylation and

hydrogenation. The hydroformylation catalyst may be a compound of ruthenium, Ir, Rh or Os.

FUEL CELLS

Nuclear Fuel Processing

ALKEM G.m.b.H. *European Appl. 100,941*

Spent fuel rods are heated to expand the sheathing. The fuel released is dissolved in an O₂ atmosphere where Ru and other platinum group metals are lost as volatile compounds with O. They are recovered in a cold trap.

Fuel Cell Electrode

HITACHI LTD. *U.S. Patent 4,407,905*

In an improved, stabilised, gas-diffusion electrode for a fuel cell, a conductive permeable substrate is coated with a catalyst consisting of colonies of primary metal particles uniformly distributed on a carrier powder. The metal is a platinum group metal.

Fuel Cell Electrode

U.S. DEPARTMENT OF ENERGY *U.S. Patent 4,407,906*

An improved catalytic electrode for use in a phosphoric acid fuel cell consists of a graphitised C substrate coated with a Pd-Pt alloy in a hydrophobic binder.

Fuel Cell Reactor

W. R. GRACE & CO. *U.S. Patent 4,413,041*

A fuel cell reactor consists essentially of a stack of ribbed solid electrolyte sheets (ZrO₂ stabilised with CaO or Y oxide) coated with a catalyst such as Pt or Pt-Rh alloy.

CORROSION PROTECTION

Corrosion Protection System

TEXAS INSTRUMENTS INC. *U.S. Patent 4,407,711*

In an impressed-current corrosion-protection system for hot-water tanks, the electrochemically active non-sacrificial anode consists of a strand of Ti, Nb or Ta coated with Pt, Ir and/or Ru.

CHEMICAL TECHNOLOGY

Hydrogen Purification Apparatus

CONSOLIDATED TECHNOLOGY CORP.
British Appl. 2,124,423A

An apparatus for safely purifying H₂ gas and a method for preventing explosions in laboratory scale H₂ gas diffusion purification units, which may use a series of Ag-Pd tubes, are described.

Colour Photographic Material

KONISHIROKU PHOTO INDUSTRY CO. LTD.
British Appl. 2,125,980A

Ag halide colour photographic material has a light-sensitive Ag halide emulsion layer containing at least

one cyan-forming coupler and optionally Au sensitizers, such as K chloroaurate, or sensitizers of water-soluble salts of Ru, Rh, Ir, Pt or Pd, such as ammonium chloropalladate or K chloroplatinate. A Pd/C catalyst is used as a hydrogenation catalyst in the production of the couplers.

Metals Recovery

NATIONAL RESEARCH DEVELOPMENT CORP.

U.S. Patent 4,412,893

In a method for recovering metals more noble than Fe by electrolysis of their salt solutions in the presence of ferrous ions, relative motion is maintained between the solution and the anode which is of graphite, Pt, platinised Ti, Ti coated with Ir oxide or Pt coated with Ir oxide.

GLASS TECHNOLOGY

Metallised Glass-Ceramics

CORNING GLASS WORKS *U.S. Patent 4,414,281*

Machinable glass-ceramics having an integral surface layer of Cu or Ag are made by fusing specified mixtures of SiO₂, Mg oxide, Mg fluoride, K oxide or Ba and Sr oxides, Al₂O₃, B₂O₃ and Cu oxide or Ag oxide in a Pt crucible, shaping, and heating in a reducing atmosphere.

Glass Ceramics

U.S. DEPARTMENT OF ENERGY *U.S. Patent 4,414,282*

Glass ceramic compositions for making seals to Inconel are made by fusing specified oxide mixtures in a Pt or Pt-Rh crucible.

Flat Glass Manufacture

EGLASSTREK PATENT PROMOTION & AWARDFUNDING G.M.B.H. *German Offen. 3,329,843*

In a process for making flat glass, a stream of molten glass is drawn across a flat refractory or Pt alloy surface by a Pt alloy or stainless steel device.

ELECTRICAL AND ELECTRONIC ENGINEERING

Permanent Magnet

LITTON SYSTEMS INC. *British Appl. 2,124,033A*

Radially directed internal magnetisation, for instance in a bearing, is obtained by forming a magnet from axial slices which are stacked to form a cylinder with a central bore. Pt-Co and lanthanide-Co magnet alloys are preferably used.

Magnetic Recording Medium

HITACHI LTD. *European Appl. 99,564*

A recording medium free from spike noise has a high permeability magnetic material film, an antiferromagnetic material film and a perpendicularly oriented magnetic film. The high permeability film may be made of a Co-Ru alloy.

Thermal Treatment of Semiconductor Powders

CIBA-GEIGY A.G. *European Appl. 99,860*

The photoredox properties of a wide variety of chalcogenide semiconductor powders (among them Ag sulphide) are improved by heat treatment at up to 150°C under pressure. The products may be coated with metal, especially Pt.

Microcircuit Assembly

HUGHES AIRCRAFT CO. *U.S. Patent 4,410,874*

A large area hybrid microcircuit assembly includes thick film leads preferably made from pastes of Pt-Ag or Pt-Au alloy.

Sparking Plug

NGK SPARK PLUG CO. LTD. *U.S. Patent 4,414,483*

In a specified powder metallurgy process spark plug electrodes are made from alloys of Ag and Au with each other and/or Pt, Pd and/or Cr.

Rhodite Resistor Paste

U.S. PHILIPS CORP. *U.S. Patent 4,415,486*

A resistor paste consists of an organic vehicle, a glass frit and one of a rhodite, Ag₃Pd_{1-x}RhO₂ or its alloy with Ag and Pd, or Ag-Pd alloy particles coated with the rhodite.

Thick Film Inks

R.C.A. CORP. *U.S. Patent 4,415,624*

Thick film resistor or conductor inks based, respectively, on RuO₂, and a precious metal and Bi oxide, can be fired in air when the frit used is a Ca Ba borosilicate glass.

Electrode for Printing

INTERNATIONAL BUSINESS MACHINES CORP. *U.S. Patent 4,415,905*

The wear resistance of an electrolytic printing electrode is considerably increased by coating the substrate tip with a thin layer of TiO₂ and Ru oxide.

Iridium Oxide Electrochromic Devices

BELL TELEPHONE LABORATORIES INC. *U.S. Patent 4,416,516*

A new combination of an electrochromic Ir oxide electrode and a Ta oxide counter electrode produces a device which has a short circuit memory, colouration threshold and response time.

Thick Film Conductor

E. I. DU PONT DE NEMOURS & CO. *U.S. Patent 4,416,932*

A thick film conductor composition suitable for use in terminations for hermetic ceramic capacitors consists of a mixture of 30–80% finely divided noble metal or alloy (preferably a mixture of Ag, Pt and Pd), 1–20% finely divided low-viscosity glass, 0.1–10% metal oxide capable of reacting with Al₂O₃ to form a spinel and 0.1–2% organotitanium complex, especially an alkoxy complex.

Magnetic Recording Medium

T.D.K. ELECTRONICS CO. LTD. *U.S. Patent 4,416,943*

Super high density recordings can be made by using a thin layer (up to 500Å) of an alloy containing at least 50% Co, and one or more of Zn, Rh and Ir.

Thermionic Cathodes

EMI-VARIAN LTD.

U.S. Patent 4,417,173

Thermionic electron-emitters consist of a porous matrix of W, impregnated with a Group IIA metal activator, coated with 1 µm of a sigma phase alloy such as an alloy of Os, Ir or Rh with Mo, Ta or Nb.

Electrical Resistors

CTS CORP.

U.S. Patent 4,418,009

Shaped electrical resistors are made by mixing powdered glass with a finely divided refractory oxide filler and a thermally decomposable resinate of Pt and/or Ru, heating to decompose the resinate, and then shaping and firing at a temperature sufficient to fuse the glass but below the softening point of the refractory oxide.

Magnetic Recording Material

N.V. PHILIPS' GLOEILAMPENFABRIEKEN

German Offen. 3,321,944

An improved magnetic recording material consists of a non-magnetic substrate coated with a film of Co containing 1.5–3.0 at.%Cr and 1–5 at.%Pt.

TEMPERATURE MEASUREMENT

Heater Control Device

H. SUGIMORI

British Appl. 2,124,410A

A heater control device in which energy consumption by the control circuit is largely reduced includes a temperature sensor, such as a Pt resistor.

Fast-Response Thermocouple Probe

ARMSTRONG WORLD INDUSTRIES INC.

U.S. Patent 4,419,023

In a passive fast-response insulated-foil thermocouple probe, the metal pairs forming the thermocouple junctions may be made of Pt-Rh alloys.

MEDICAL USES

Oxygen Sensor

POLYSTAN (GREAT BRITAIN) LTD.

British Appl. 2,124,387A

A polarographic O₂ sensor intended primarily for measuring levels of O₂ in blood during by-pass surgery may include a Ag anode and a Pt cathode.

Prosthetic Package

TELECTRONICS PTY. LTD.

British Appl. 2,124,495A

Twenty two metallic tubes, preferably Pt, are placed in small holes in a ceramic plate to form feed-

throughs in an implantable medical prosthetic package which includes a coil in the tube of biocompatible material, preferably Pt.

Wound Dressings

UNIVERSITY OF STRATHCLYDE *European Appl. 99,758*

In a multilayer wound dressing, especially for use in combination with the application of electrical stimuli, a biodegradable tissue interface layer such as collagen is preferably coated on to a layer of fabric plated with Ag, Au or Pt, for example, protected on its other side with a semipermeable membrane of collagen or Ca alginate.

Biological Electrochemical Sensor

HELLIGE G.M.B.H.

European Appl. 102,033

An electrochemical sensor for the transcutaneous measurement of CO₂ partial pressure in a living body uses an Ir/Ir oxide/membrane measuring electrode in contact with a buffer solution mounted on a Cu or Ag base.

Dental Jacket Crown

I. SHOHER

European Appl. 104,320

The crown is prepared from a thin metal foil substrate coated with a noble metal composition of low melting point, for example a Pt foil coated with Au. The foil is folded into a number of triangular flaps or pleats to form the jacket on a die.

Pacemaker Electrode

TELECTRONICS PTY. LTD.

U.S. Patent 4,408,604

A procedure for fabricating a porous Pt electrode tip for a cardiac pacemaker is claimed.

Platinum Diamine Complexes

NETHERLANDS TNO

U.S. Patent 4,410,544

Complexes of Pt with a large number of diamines may be used in the treatment of tumours and are considerably less toxic than cisplatin.

Dental Alloys

JENERIC INDUSTRIES INC.

U.S. Patent 4,419,325

A dental alloy for use in porcelain-fused-to-metal restorations includes Pd, Ga and optionally Cu, Au, Al, Co, Ru or Re. The Ru or Re provides grain refining for the alloy to increase its elongation, tensile strength and thus toughness.

Platinum Dioxypyrimidine Complexes

RESEARCH CORP.

U.S. Patent 4,419,351

Blue or green Pt-(2,4-dioxypyrimidine) complexes, useful as anti-tumour, anti-bacterial and anti-viral agents, are prepared by reacting a 2,4-dioxypyrimidine with cis-diaquodiammine Pt(II) at 0–55°C and pH 3–8.

Radiodiagnostic Agents

M. WENZEL

German Offen. 3,218,859

Useful agents for examining adrenal activity are labelled metallocenes of general formula Cp₂MCH₂NHCH₂R, where M is Ru, Os or Fe.