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NEW PATENTS

ELECTRODEPOSITION AND SURFACE COATINGS

Palladium Activator for Plating on Plastic

HANGZHOU ORIENTAL MET. FINISHING TECHNOL. CO LTD *Chinese Appl.* 1,936,097

Plastic can be activated for plating using an activator containing (in g l^{-1}): 0.05–10 Cu(I) salt; 0.05–2 Pd(II) compound; 2.5–200 Sn; plus 35% HCl 50–800 ml l^{-1}. The steps followed are: deoiling, cleaning, roughening, cleaning, activating at 10–70°C for 0.5–10 min, cleaning, treating with a basic solution containing Cu ions, then plating. The process is claimed to be simple, stable and environmentally friendly. The activator is claimed to have high activity.

APPARATUS AND TECHNIQUE

Ignition Device with Iridium-Based Firing Tip

FEDERAL MOGUL IGNITION UK LTD *European Appl.* 1,782,513

An ignition device such as a spark plug for an internal combustion engine includes centre and ground electrodes, at least one of which includes a firing tip formed from an Ir alloy. The alloy contains (in wt.%): 1–3 Rh, 0.1–0.5 W, 0.01–0.05 Zr, preferably ~ 2 Rh, ~ 0.3 W, ~ 0.02 Zr, with the balance Ir. The ground electrode firing tip may alternatively be made from Pt or a Pt alloy.

Microchannel Apparatus with Platinum Aluminide

VELOCRYS INC *World Appl.* 2007/047,373

A microchannel reactor or separator contains at least one microchannel defined by a wall coated with PtAl, with optionally a layer of Al_2O_3 and one of catalytic or sorbent material. The PtAl layer may be a post-assembly coating, and the reactor or separator made by laminating together sheets. Pt may be coated by electroless plating. A reaction may be carried out by passing a reactant into the microchannel to form at least one product; if the reactant is a hydrocarbon then the reactor can be used to effect hydrocarbon steam reforming. Essentially no coke is formed in the microchannel.

Adsorption of VOCs Including Ethylene

JOHNSON MATTHEY PLC *World Appl.* 2007/052,074

Pd-doped ZSM-5 (1) is used to adsorb volatile organic compounds such as C_2H_4, HCHO or CH_3CO_2H from perishable organic matter which may include foods such as fruit or vegetables, horticultural produce such as cut flowers or plants, or refuse. (1) may be incorporated into a storage container, package or label and may be used with a VOC indicator. The used (1) can be regenerated for further use by heating to 250°C for 30 min in air to release the adsorbed VOCs. Ratio of Si:Al in the ZSM-5 is ≤ 100:1, preferably 22:1–28:1; and Pd content is 0.1–10.0 wt.%, preferably 0.5–5.0 wt.%.

Osmium-Based Oxygen Sensor

W. B. CARLSON *et al.* *U.S. Appl.* 2007/0,105,235

A luminescent Os complex $[Os(II)(N–N)_2L\text{-}L]^{2+}$ $2A^-$ or A^{2-} (1), where N–N is a 1,10-phenanthroline ligand; L-L is *cis*-1,2-bis(diphenylarseno)ethylene or *cis*-1,2-bis(diphenylphosphino)ethylene; and A is a counter ion; plus an O_2 permeable host material, is used in a pressure sensitive paint. The pressure of an O_2-containing fluid flowing over an aerodynamic surface, such as an aircraft part, can be measured by illuminating the coated surface to cause luminescence of (1), then measuring the luminescent intensity.

Ruthenium-Containing Biosensor

NATL. YUNLIN UNIV. SCI. *U.S. Appl.* 2007/0,095,664

A biosensor includes an extended gate field-effect transistor structure which has a metal oxide semiconductor field-effect transistor and at least one sensing unit, with a Ru-containing layer as a sensor, connected by a metal wire. The Ru-containing film is chosen from Ru oxide or RuN and is coated onto the extended gate region substrate by radio frequency sputtering. The sensor system can be used for measuring pH of solutions or in a vitamin C biosensor.

Platinum-Gold Gas Sensor Electrodes

DELPHI TECHNOL. INC *U.S. Patent* 7,241,477

A method for forming a PtAu alloy electrode for use in a gas sensor includes combining Pt and Au precursors to form an electrode ink, forming the ink into an electrode precursor, firing and treating in an environment of ≤ 500 ppm O_2 to produce an electrode with an exposed surface Au concentration ≥ 6 times the bulk Au concentration. The electrode ink contains (in wt.%): 43–62 Pt, 0.05–1 Au and 38–48 fugitive material, plus optionally 2–8 oxides.

HETEROGENEOUS CATALYSIS

Iridium Catalyst for Methane-Containing Waste Gas

OSAKA GAS CO LTD *European Appl.* 1,790,412

A catalyst for removing hydrocarbons from combustion exhaust gas containing CH_4 and excess O_2 contains Ir plus Pt, Pd, Rh and/or Ru, supported on ZrO_2, and has specific surface area 2–60 m^2 g^{-1}. Ir is present in 0.5–20 wt.%, preferably 1–5 wt.%, relative to ZrO_2. Where Pt is used, it is present in 2–100 wt.%, preferably 5–50 wt.%, relative to Ir. Alternatively or in addition to Pt, elements Pd, Rh and/or Ru may be present in 0.5–10 wt.%, preferably 1–5 wt.%, relative to Ir.

Zoned Oxidation Catalyst for Exhaust System

JOHNSON MATTHEY PLC *World Appl.* 2007/077,462

An exhaust system for a lean-burn internal combustion engine includes a catalyst for oxidising CO and hydrocarbons. A flow-through substrate monolith supports three washcoat zones each containing at least one metal selected from Pt, Pd, Rh and Ir, preferably Pt. Metal loadings in each washcoat zone are (in g ft^{-3}): 10–240 in the first, 5–30 in the second and 10–120 in the third; 25–390 total metal loading.

Dry Impregnation of Platinum on Carbon Substrate

UNIV. ILLINOIS *U.S. Appl.* 2007/0,105,007

A method of preparation for particles of a metal selected from Pt, Pd, Rh, Ru, Ir, Os, Sn or Cu, preferably Pt, supported on a C substrate such as C black is claimed. An aqueous solution of metal complex in a volume of H_2O not exceeding the pore volume of the C substrate is contacted with the substrate, allowed to absorb, then heated under reducing conditions to form particles. The pH of the solution is adjusted if necessary to < 2 and the Pt-loaded substrate is heated to 200–300°C. Particles have diameter 15–25 Å and Pt is highly dispersed, at least 120 m^2 Pt g^{-1} Pt, with Pt loadings ≥ 20%.

Carbon Monoxide Catalyst

A. CHIGAPOV *et al.* (FORD GLOBAL TECHNOL. LLC) *U.S. Appl.* 2007/0,129,247

A low-temperature selective CO oxidation catalyst contains 1–20 wt.% Pt and 1–30 wt.% Co, and has > 90% conversion efficiency at ≤ 140°C. Alternatively the catalyst may contain 1–10 wt.% Pt and 1–4 wt.% Co and have conversion efficiency > 50% at 22–33°C. The weight ratio of Pt:Co is between 1:2–4:1. Applications may include removal of CO from H_2-rich gas for fuel cells, from exhaust gas during cold-start of diesel or petrol engines, or for air purification systems for spaces such as tunnels, underground railways, multi-storey carparks or submarines.

Iridium Catalyst for Hydrazine Decomposition

KOREA AEROSPACE RES. INST. *U.S. Appl.* 2007/0,167,322

An Ir catalyst is claimed which has high crush strength and can be used for hydrazine decomposition for spacecraft and satellite propulsion. Bauxite is contacted with 0.1–10 M acid solution for 10–14 h; the mixture is filtered; the filtered bauxite is thermally treated by contacting with air at 500–700°C for 2–6 h, then loaded with Ir from a solution containing $IrCl_3$, $Ir[(NH_3)_5Cl]Cl_2$, H_2IrCl_6 or $Ir(NH_3)_6Cl_3$. The loading step may be repeated 10–20 times to give an Ir loading of 30–35 wt.% relative to bauxite. In a final step, the catalyst is reduced.

Exhaust Gas Purifying Catalyst

MAZDA MOTOR CORP *U.S. Patent* 7,235,511

A catalyst includes a carrier and a catalyst layer which includes a noble metal on active Al_2O_3, Rh carried on an O storage agent, Rh carried on Al_2O_3 coated with ZrO_2 and a binder material. The O storage agent may be a CeO_2-ZrO_2-Nd_2O_3 composite.

Shift Reaction Catalyst

NISSAN MOTOR CO LTD *Japanese Appl.* 2007-007,531

A water gas shift reaction catalyst includes Pt, Ce and Cu and is prepared by mixing a Pt catalyst powder containing Ce, with a Cu catalyst powder. The composition may further include Ti, Zr, V, Nb or Ta. The components are present in (mg ml^{-1} by catalyst unit volume): 0.1–20 Pt, 50–500 Ce and 0.1–80 Cu. Cu is 0.1–10 mass% *vs.* Pt. The support is an inorganic oxide of Si, Al, Ti, Ce or Zr.

HOMOGENEOUS CATALYSIS

Synthesis of Aryloctanoyl Amide Compounds

NOVARTIS AG *British Appl.* 2,431,652

An alternative synthesis of (2*S*, 4*S*, 5*S*, 7*S*)-2,7-dialkyl-4-hydroxy-5-amino-8-aryloctanoyl amide derivatives or pharmaceutically acceptable salts thereof, in particular aliskiren, uses a Pd-catalysed coupling reaction. Novel compounds used as intermediates in the synthesis of the target compounds are also claimed.

Ruthenium Metathesis Catalysts

MATERIA INC *World Appl.* 2007/075,427

Ruthenium alkylidene complexes having an *N*-heterocyclic carbene ligand with a 5-membered heterocyclic ring containing at least one phenyl-substituted N atom bonded directly to a carbenic C atom are claimed. The complexes can be used as catalysts for olefin metathesis reactions, in particular for preparation of tetra-substituted cyclic olefins by ring closing metathesis.

Hydrogenation Process

DAVY PROCESS TECHNOL. LTD *U.S. Appl.* 2007/0,142,679

A continuous homogeneous process for hydrogenation of dicarboxylic acids and/or anhydrides uses a catalyst containing Ru, Rh, Os, Pd or Fe, preferably Ru, with an organic phosphine, preferably a tridentate phosphine. Products may include butanediol, THF and/or γ-butyrolactone from fumaric acid or maleic or succinic acid or anhydride. The process is carried out in the presence of ≥ 1 wt.% H_2O, at 500–2000 psig and 200–300°C, so that ~ 1–10 mol $H_{2(g)}$ are used to strip 1 mol product from the reactor. The catalyst can be regenerated in the presence of H_2O and $H_{2(g)}$.

FUEL CELLS

Ruthenium-Selenium Alloy Cathode Catalyst

SAMSUNG SDI CO LTD *European Appl.* 1,786,053

A cathode catalyst for a fuel cell includes a Ru-Se alloy with average particle size ≤ 6 nm, preferably 3–5 nm, preferably as an amorphous catalyst. The composition contains 3–20 wt.% Se *vs.* Ru, and Ru makes up 10–90 wt.% of the total catalyst composition. The catalyst is prepared by drying a solution containing $RuCl_3$ hydrate, Ru acetylacetonate, Ru carbonyl or a mixture, heat treating the product, then adding a solution containing selenous acid and heat treating a second time.

Platinum-Gold Alloy Catalyst

JOHNSON MATTHEY PLC *European Appl.* 1,807,200

A catalyst for a fuel cell is formed from an alloy of composition PtAuX, where X is a transition metal such as Cr, Ti or Cu, with (in %): 40–97 Pt, 1–40 Au and 2–20 X. The alloy may be dispersed on a conductive C material to form a catalyst, an electrode may be formed from the catalyst deposited on an electrically conductive substrate, or a catalysed membrane formed from the catalyst deposited on a polymer electrolyte membrane.

Catalyst Layer for PEMFC

CANON KK *U.S. Appl.* 2007/0,099,066

An electrode catalyst layer for a PEMFC has an entangled ('cobweb-like') structure formed by reducing a thin film layer containing Pt or a Pt alloy and O plus N and/or B. The entangled structure has thickness 3–100 nm and porosity 30–95%, and may be carried on a support such as C, Pt/C, Pt alloy/C, Pt black, Pt particles, Pt alloy particles or Au particles.

Manufacture of Platinum Nanoparticles Using Plasma

AJOU UNIV. IND. COOP. FOUND. *Korean Appl.* 2007-0,010,715

Pt nanoparticles for an electrode catalyst in a fuel cell are synthesised using plasma technology. A Pt compound is dissolved in water with an acid and a base in a plasma reactor. $H_{2(g)}$ and an inert gas are mixed and injected into the reactor. Direct or alternating current or microwave energy are applied *via* two electrodes, placed at the solution side and the gas side respectively, causing plasma discharge at the interface between the Pt-containing solution and the mixed gas to induce reduction to Pt nanoparticles.

CORROSION PROTECTION

Corrosion-Resistant Plating Structure

GNC CO LTD *Korean Appl.* 2007-0,021,601

A plastic material such as a resin or an engineering plastic is plated with a chemical plating layer of Ni or Cu to provide conductivity, a layer of Cu, a layer of Ag and layers of Pt, Pd, Rh or Ru to provide corrosion resistance. Formation of pin holes during the plating process is reduced, and galvanic corrosion is suppressed in a salt water environment.

CHEMICAL TECHNOLOGY

Leaching Process for the Recovery of Metals

ANGLO OPERATIONS LTD *World Appl.* 2007/074,360

A metal such as a Pt group metal, Au, Zn, Cu, Ti, Al, Cr, Ni, Co, Mn, Fe, Pb, Na, K or Ca can be leached from an ore in the presence of HCl to form a soluble metal chloride salt. H_2SO_4 and/or SO_2 are added to the leach solution during or after the leaching step, and a solid metal-sulfate or -sulfite salt is recovered. HCl is regenerated and continuously transferred to the vapour phase, and is then captured and returned to the leaching step.

ELECTRICAL AND ELECTRONIC ENGINEERING

Plating Printed Circuit Board

YMT CO LTD *U.S. Appl.* 2007/0,104,929

A PCB is plated as follows. A bare soldering and a wire bonding portion made from Cu or Cu alloy are coated with a Pd or Pd alloy layer, then a Au or Au alloy layer, by electroless deposition. The Pd alloy layer may contain 91–99.9 wt.% Pd and the balance P or B, and has thickness 0.05–2 μm. The Au alloy layer may contain 99–99.99 wt.% Au with Tl, Se or a mixture, and have thickness 0.01–0.25 μm. The method may be used to coat rigid, flexible or rigid-flexible PCBs.

Enhanced Nucleation of Ru Films

NOVELLUS SYSTEMS INC *U.S. Patent* 7,211,509

A Ru layer can be deposited on a dielectric substrate by exposing the substrate to an amine-containing compound then to a Ru precursor (such as ruthenocene, $Ru(acac)_3$, $Ru(CO)_5$, etc.), and an optional oxidising or reducing coreactant. The amine-containing compound facilitates nucleation on the dielectric surface.

Magnetic Recording Medium

FUJIFILM HOLDINGS CORP *Japanese Appl.* 2007-018,625

A magnetic recording medium has a B2 metal alloy seed layer, an underlayer of Ru and a magnetic layer of CoPt coated on the surface of a non-magnetic supporting body. The seed layer has a column structure with diameter 5–20 nm and its surface is oxidised. The B2 metal alloy may consist of M:Al in the ratio 50:50, where M = Ru, Pd, Pt, Rh, Ir, Os, Ni, Fe or Mn.

Diphasic Magnetic Nanomaterial

HEBEI UNIV. TECHNOL. *Chinese Appl.* 1,943,923

A magnetic nanomaterial $Sm_2Fe_{17}N_3$-Fe_3Pt, with crystal diameter ≤ 30 nm, includes a matrix phase of retentive 2:17 type rare earth Fe nitride with finely dispersed nanoparticles of body-centred non-retentive Fe_3Pt. The method of preparation includes the steps of smelting 2–3 times at 50–300 A for 2–3 min; melting by high-frequency inductance coil in a quartz tube; pre-annealing at 350°C and 5×10^{-3} Pa for 30 min; crystallising at 5×10^{-4} Pa and 700–800°C for 25 min; and cracking and nitriding at 480°C and 1 atm for 6 h. The material is claimed to give higher magnetic performance than monophasic retentive magnetic materials.

MEDICAL USES

Combination Therapy Using Satraplatin

GPC BIOTECH AG *World Appl.* 2007/054,573

A combination therapy for prevention or treatment of cancer or tumours uses a packaged pharmaceutical including a Pt-based chemotherapeutic agent such as satraplatin, plus an inhibitor of a EGFR family receptor or a chemotherapeutically active pyrimidine analogue. The two components are administered within about 14 days of each other.

Implantable Palladium Alloy Medical Device

COOK INC *World Appl.* 2007/070,544

An implantable medical device includes at least one portion made of a radiopaque Pd alloy, preferably containing ≤ 20 wt.% Re or alternatively (in wt.%): ≤ 10 Ru; ≤ 30 Rh; ≤ 30 Ir; 10–20 Pt; ≤ 30 Mo; ≤ 30 W; ≤ 20 Ta; 10–50 Ag; 10–50 Ag plus 5–10 Cu; ~ 26 Ag plus ~ 2 Ni; ≤ 20 Re plus ≤ 30 W; or 9.5 Pt, 9 Au, 14 Cu plus 32.5 Ag. The radiopacity is at least equivalent to that of Pt-8 wt.% W, ultimate tensile strength is > 200 ksi and elongation to fracture is ≤ 5%. The device may be a wire guide, embolisation coil, marker band, stent, filter, RF ablation coil or an electrode.