

Patents

CATALYSIS – APPLIED AND PHYSICAL ASPECTS

Palladium-Gold Catalyst

Lyondell Chemical Technology, *US Appl.* 2012/0,302,784

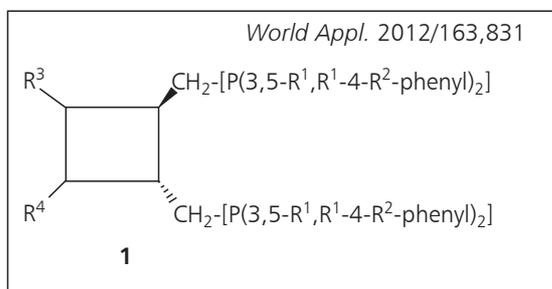
A Pd-Au catalyst is prepared by the following method: (a) mixing TiO₂, a carboxyalkyl cellulose and a hydroxyalkyl cellulose to form a dough; (b) extruding the dough to produce an extrudate; (c) calcining the extrudate to produce a calcined extrudate; (d) impregnating the calcined extrudate with Pd and Au compounds to produce an impregnated extrudate; and (e) calcining the impregnated extrudate to produce the Pd-Au catalyst. This catalyst is used in producing vinyl acetate by oxidising ethylene with oxygen in the presence of acetic acid.

CATALYSIS – REACTIONS

Reusable Hydroformylation Catalyst

Umicore AG & Co KG, *World Appl.* 2012/163,831

A novel process for producing 4-hydroxybutyraldehyde is claimed, where an allyl alcohol is reacted in polar solvents with CO and H₂ in the presence of a catalyst which is formed from a Rh complex and a cyclobutane ligand e.g. *trans*-1,2-(1,3-dialkylphenylphosphinomethyl)-cyclobutanes, **1**, where R¹ is alkyl, preferably methyl, ethyl or propyl; R² is H or an alkoxy group; R³ and R⁴, independently of one another, are H, CH₂OR¹, CH₂O-alkyl, CH₂OH, CH₂[P(3,5-R¹,R¹-4-R²-phenyl)₂], or CH₂O-(CH₂-CH₂-O)_m-H; where *m* is 1–1000. The hydroformylation takes place in a membrane reactor and the catalyst used is separated off from the reaction mixture, optionally after adding water, by extraction with hydrophobic solvents and is reused.



Catalyst for Alkylation of Aromatic Compounds

Stamicarbon BV, *European Appl.* 2,540,691; 2013

A method for the alkylation of an aromatic compound involves the aromatic compound making contact with an alkane of 1–12 C atoms at 200–500°C, preferably 320–400°C, in the presence of a catalyst composition consisting of a catalytically active metal selected from Pt, Pd, Rh, Os, Ir, Ru or a combination and a promoter metal, e.g. Zn, on a zeolite support. The molar ratio of the promoter metal to the catalytically active metal is between 0.01 and 5, preferably between 0.1 and 0.5.

Catalyst for Naphtha Reforming

OOO Nauchno-Proizvodstvennaya Firma, *Russian Patent* 2,471,854; 2013

A catalyst for reforming gasoline fractions comprises (in wt%): 0.1–1.0 Pt; 0.1–1.0 Cl; 0.5–3.9 zeolite; 1–2 amorphous Al₂SiO₅; γ-Al₂O₃; and optionally 0.1–0.5 Re. Al(OH)₃ powder is mixed with zeolite, this mixture is peptised with 0.5–20% organic acid, e.g. citric acid, it is then granulated, heat treated at 630–700°C and this is followed by the addition of Pt in the form of an aqueous solution of chloroplatinic acid and chlorine in the form of HCl. The catalyst is then dried and annealed.

EMISSIONS CONTROL

Platinum Group Metal Catalyst

Johnson Matthey Plc, *World Appl.* 2012/170,421

A catalyst for treating exhaust gas consists of an aluminosilicate molecular sieve comprising crystals with a porous network and at least one pgm with the majority of the selected pgm embedded in the porous network relative to the pgm disposed on the surface in a ratio of ~4:1 to ~99:1. The catalyst comprises ~0.01–10 wt% pgm relative to the weight of the molecular sieve and the crystals have a mean crystalline size of ~0.01–10 μm. A method for treating emissions comprises of: (a) contacting a lean burn exhaust stream containing NO_x and NH₃ with the catalyst at ~150°C–650°C; and (b) reducing a portion of NO_x to N₂ and H₂O at ~150°C–250°C and oxidising a portion of NH₃ at ~300°C–650°C.

Cold Start Catalyst

Johnson Matthey Plc, *US Appl.* 2012/0,308,439

A cold start catalyst consists of: (a) a zeolite catalyst comprising a base metal, a noble metal and a zeolite;

and (b) a supported pgm catalyst comprising one or more pgms and one or more inorganic oxide carriers. The noble metal is selected from Pt, Pd, Rh or a mixture. The zeolite catalyst and the supported pgm catalyst are coated onto a flow-through substrate in an exhaust system.

Three-Way Catalyst Microwave Drying

X. Weng *et al.*, *Chinese Appl.* 102,614,942; 2012

A TWC drying technique consists of taking porous cordierite as the support and coating the surface of its internal pores with a catalyst slurry which contains H₂O, composite Al₂O₃, CeO₂-ZrO₂ oxygen storage material and Pd or Rh. The catalyst slurry coated support is then introduced through microwave devices and dried at 1400–2500 MHz microwave to have a water content <7%. The advantages of the microwave drying technique include rapid heating speed, high production efficiency, good working environment, reduced energy consumption and an increase of catalytic performance of the catalyst.

FUEL CELLS

Nanostructured Platinum Catalyst

Atomic Energy and Alternative Energies Commission, *World Appl.* 2013/017,772

The process for producing a catalyst Pt_xM_y for PEMFC, where M is a transition metal selected from Ni, Fe, Co and Cr, involves: (a) deposition of Pt_xM_y nanostructures on a support by sputtering; (b) annealing the nanostructures at 600–1200°C preferably for 1 h; and (c) depositing a layer of Pt_xM_y onto the surface of the nanostructures; and (d) then leaching the metal M. The catalyst is made with Pt₃Ni. The support is the GDL and the thickness is preferably 200 μm.

Microbial Fuel Cell

Gwangju Institute of Science and Technology, *US Appl.* 2012/0,315,506

A microbial fuel cell system consists of a unit cell where the anode is formed on the bottom surface and the cathode is formed on the top surface of a reactor which accommodates electrochemically active microorganisms and an ion exchange membrane is interposed between the two electrodes. The cathode consists of a carbon electrode treated with Pt, Pd, Os or Ru. The unit cells are arranged vertically and are electrically connected to each other in series through a conductive film to form a module.

Platinum-Rhodium Catalyst

Tokuyama Corp, *Japanese Appl.* 2013-037,891

A Pt-Rh catalyst for DMFCs consists of a ratio of 0.10–2.00 mol Rh to 1 mol Pt. The catalysts show a high MeOH oxidation current at a low voltage in an alkaline environment. Electrodes containing the title catalysts can be bonded to anion-exchange membranes and used in MEAs.

METALLURGY AND MATERIALS

Black Fire Retardant Silicone Rubber

Shanghai University of Engineering Science, *Chinese Appl.* 102,643,552; 2012

A black fire retardant silicone rubber is prepared with (in wt%): 50–60 vinyl- or allyl-capped silicone rubber; 5–10 hydrogen-containing polysiloxane; 0.1–0.3 soluble Pt catalyst; and 29.7–44.9 fire retardant which is a mixture of carbonised residue of waste tyre pyrolysis and (NH₄)₂HPO₄. The method of preparing the black fire retardant silicone rubber involves adding the carbonisation residue of waste tyre pyrolysis and (NH₄)₂HPO₄ into the vinyl- or allyl-capped silicone rubber, stirring, adding the hydrogen-containing polysiloxane and the Pt catalyst, stirring, ball milling, vacuum air exhausting and finally curing at 20–40°C.

MEDICAL AND DENTAL

Palladium Braze

Boston Scientific Neuromodulation Corp, *US Patent* 8,329,314; 2012

An implantable microstimulator comprising a component assembly housing which consists of a ceramic part, a metal part selected from Ti and Ti alloys and a Pd interface layer is claimed. The interface layer comprises Pd which is combined with a portion of one or both of the metal part or the ceramic part, forming a bond between the two parts and further comprising an electrode contact. A second Pd interface layer bonds the electrode contact to the ceramic part of the component assembly housing.

REFINING AND RECOVERY

Separation of Pure Osmium

The Curators of the University of Missouri, *World Appl.* 2013/020,030

A process for separating Os including from an irradiated Os-191 mixture, involves: (a) the mixture is put into contact with an aqueous solution of NaClO at a concentration of ~12% available Cl₂ to form a volatile

OsO₄ vapour; (b) the OsO₄ vapour is bubbled through a trapping solution which consists of an aqueous solution of KOH at a concentration of ~25% w/v to form dissolved K₂[OsO₄(OH)₂]; (c) the dissolved K₂[OsO₄(OH)₂] is put in contact with an aqueous solution of NaHS at a concentration of ~10% w/v to form an OsS₂ precipitate; (d) the OsS₂ precipitate is washed by agitating with H₂O; (e) the OsS₂ precipitate is separated from the KOH trapping solution by centrifuging; (f) the OsS₂ precipitate is rinsed with acetone; and (g) the OsS₂ precipitate is then dried. The advantages of this process are the use of simple reactions and equipment, and a shorter process time; therefore, limiting the exposure to potentially hazardous conditions.

SURFACE COATINGS

Electroless Plating of Iridium

Japan Kanigen Co, Ltd, *Japanese Appl.* 2012-241,258

A plating solution comprises either or both of Ir³⁺ and Ir⁴⁺ plus Ti³⁺. A preferable plating solution consists of 0.2–60 mmol l⁻¹ Ir ions, 0.01–2 mol l⁻¹ Ti³⁺ and has pH 1–6. The solution may also contain 0.001–1 mol l⁻¹ mono- or dicarboxylic acids or their salts as stabilisers and 0.001–1 mol l⁻¹ N- and P-free oxidation inhibiting agents of redox potential –0.1–0.8 V *vs.* SHE, e.g. ascorbic acid, erythorbic acid, catechol, catechol disulfonic acid and their salts. High quality Ir coatings are directly formed on Cu alloys.