Patents

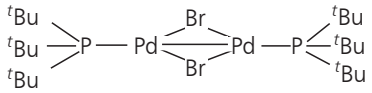
CATALYSIS – APPLIED AND PHYSICAL ASPECTS

Palladium Phosphine Complex

Johnson Matthey Plc, *World Appl.* 2011/012,889

$[Pd(P^tBu_3)(\mu\text{-}Br)]_2$, **1**, is prepared by mixing 0.05–2.5 mol l^{-1} of $Pd(diolefin)Br_2$ and $^tBu_3P$ in a solvent such as MeOH, the reaction mixture is then stirred at preferably –5–30ºC for ideally ~10 min to 1 h. The next step is the addition of an alkali hydroxide (preferably NaOH) to form the catalyst for cross-coupling reactions. The preferred molar ratios of $Pd(diolefin)Br_2$:$^tBu_3P$ and $Pd(diolefin)Br_2$:alkali hydroxide are 1:1.

World Appl. 2011/012,889



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PGM Catalyst in Hydrogen Generation

Univ. Hong Kong, *US Appl*. 2011/0,059,378

A catalyst is claimed with a tertiary metal composition, where the first metal is either Pt or Ru, the second metal is selected from Pt, Pd, Rh, Ir, Os, Ru, Au and/or Re and the third metal is Bi which is present as an oxide or a mixture of oxides and carbonates and is in the +3 oxidation state. The catalyst is used in the dehydrogenation of small organic molecules such as MeOH. A preferred embodiment, $Pt_aRu_bBi_cO_x$, where $0.3 \le a \le 6.5$, $b = 1$, $0.1 \le c \le 6.4$ and $0.15 \le x \le 9.6$ can be in the form of a NP (2–100 nm in cross-section) and the supporting material comprises C, TiO_2, Al_2O_3 or SiO_2.

CATALYSIS – REACTIONS

Osmium Complexes for Carbonyl Reduction

Univ. Degli Studi Udine, *World Appl*. 2011/033,022

New Os complexes $[OsX_2(P_2)(diamine)]$ (P = P atom of a diphosphine; X = anionic ligand) are prepared for catalysing the reduction of carbonyl compounds. This catalyst is prepared by selecting an Os precursor ($[OsX_2(PAr_3)_3]$ (Ar = Ph, *p*-tolyl), $[Os_2X_4(P(m\text{-tolyl})_3)_5]$ and OsX_2("ligand") where the ligand is selected from C_6H_6, *p*-cymene or cyclooctadiene) and reacting this in an organic solvent at 40–120ºC with both the diphosphine ligand and diamine ligand added in excess of the reaction stoichiometry.

PGM Catalyst for the Production of Hydrocarbons

E. Harlin *et al*., *US Appl*. 2011/0,087,058

A feedstock selected from fats and oils which originate from plants, animals or other biomass is deoxygenated by making contact with CO in the presence of a catalyst selected from Pt, Pd, Rh, Ir, Os, Ru, Re, Mn, Mo, Zn, Co or Cu. This reaction is carried out in the presence of water, under alkaline conditions at 150–350ºC under 0.1–150 bar to produce hydrocarbons which are suitable as biofuels.

EMISSIONS CONTROL

PGM Washcoat on Diesel Particulate Filter

Int. Eng. Intellectual Prop. Co, LLC, *European Appl*. 2,290,203 (2011)

A DPF includes a washcoat of at least one metal selected from Pt and Pd added to the surface and pore structure of the filter material. This washcoated filter material is a thin band located adjacent to the inlet. The DPF should improve the distance between active regenerations and may prevent HC/CO slip.

Platinum and Palladium Three-Layered Catalyst

Heesung Catal. Corp, *US Patent* 7,931,874 (2011)

A three-layered catalyst consisting of a substrate, a lower layer of Pt, an intermediate layer of Pd and an upper layer of Pt, is used for purifying exhaust gases of an internal combustion engine. The weight ratio of Pt in the upper and lower layers ranges from 60:40 to 80:20 and the substrate is selected from cordierite, α-alumina and mullite.

FUEL CELLS

Iridium-Based Water Electrolysis Catalyst

Johnson Matthey Plc, *World Appl*. 2011/021,034

A catalyst layer in a fuel cell includes an electrocatalyst (selected from the pgms, Au, Ag or a base metal) and a water electrolysis catalyst, which consists of Ir or

IrO_2 and one or more of Ti, Zr, Hf, Nb, Ta and Sn. At the anode, the ratio of the water electrolysis catalyst to the electrocatalyst is ideally from 0.75:1 to 5:1 and at the cathode, this ratio is preferably from 0.5:1 to 1:5. The electrocatalyst and the water electrolysis catalyst may exist as separate layers in the catalyst layer but are preferably a mixed layer.

Palladium and Iridium Electrode Catalyst

Samsung Electronics Co, Ltd, *US Appl*. 2011/0,081,599

An electrode catalyst containing Pd, Ir and one metal selected from Mn, Gd, In, Y, Zr, Sn, Cr and V or an oxide of these metals can be used in a fuel cell. At least one metal is present in the range of 5–30 wt% relative to Pd. This catalyst has a carbonaceous support selected from Ketjen black, carbon black, graphite, CNT and carbon fibre.

APPARATUS AND TECHNIQUE

Platinum Coated Glass Melting Apparatus

Furuya Metal Co, Ltd, *World Appl*. 2011/027,813

A rod-shaped electrode which consists of Ir or Ir-based alloy is coated with Pt or Pt-Rh to prevent exposure to oxygen-containing gas atmosphere which can cause the oxidation of Ir. Electrolytic bubbles are prevented from being formed and higher quality of glass is produced.

Ruthenium Nanoparticles in Nitric Oxide Sensor

Cleveland State Univ., *US Patent* 7,914,664 (2011)

A composition of RuO_2 NPs either dispersed within or on the surface coating of an electrode with an electrically conductive powder selected from C, Pt, Au or a combination and perfluorinated oil is used in a NO sensor. A second coating of PEDOT and a third coating of RuO_2 NPs may be added. The weight ratio of RuO_2 NPs to electrically conductive powder is ~1:5 to ~1:7 and the thickness of the surface coating is ~1 nm–1 μm.

Growing a Single Crystal Diamond

Shin-Etsu Chem. Co, Ltd, *US Appl*. 2011/0,081,531

A base material for growing a single crystal diamond consists of a MgO film heteroepitaxially grown on one side of a single crystal silicon substrate by a sputtering or electron beam evaporation method. An Ir or Rh film is heteroepitaxially grown on the MgO film. The thickness of the single crystal silicon substrate is 0.03–20 mm and the thicknesses of the MgO and the Ir or Rh film are 5 Å to 100 μm.

ELECTRICAL AND ELECTRONICS

Platinum Complexes in Optical Data Storage

General Electric Co, *European Appl*. 2,290,408 (2011)

A data storage medium consists of a polymer matrix, a reactant able to undergo a photochemical change upon triplet excitation and a non-linear sensitiser comprising one or more Pt ethynyl complexes which are capable of absorbing actinic radiation at 405 nm and cause an upper triplet energy transfer to the reactant. The Pt complexes preferably consists of bis(tributylphosphine)bis(4-ethynylbiphenyl)platinum and bis(tributylphosphine)bis(4-ethynyl-1-(2-phenylethynyl)benzene)platinum or a combination of both.

Platinum or Palladium in Motherboard Components

Elitegroup Computer Systems Co, Ltd, *US Appl*. 2011/0,076,859

A motherboard includes a printed circuit board with connectors. Each connector has conductive terminals which consist of an electroplating layer (containing Pt, Pd, Au or Ag) formed on the surface of a substrate layer (containing Cu and Ni or Cu-Ni). The thickness of the electroplating layer is between 0.128–1.28 μm.

Joining PGMs to Carbon Nanotubes

Ulvac Japan Ltd, *Japanese Appl*. 2011-014,598

A sulfur atom is introduced into a defect of a growing CNT and metals selected from Pt, Pd, Rh, Ir, Os, Ru, Hg, Si, Ga, Au, Ag and As or their alloys can be joined to the CNT *via* the sulfur atom. This can be used to form an electrode and provide a wiring structure using CNTs.

ELECTROCHEMISTRY

Platinum and Iridium Catalyst Layer

Asahi Kasei Chem. Corp, *US Appl*. 2011/0,089,027

A catalyst layer which consists of crystalline IrO_2 ($2\theta = 34.70°$), Pt and Pt-Ir is formed on a conductive base material and used in the cathode for H_2 generation. The ratio of Pt:(Ir + Pt) is 20–50 at%. The method for making this cathode includes applying an Ir and a Pt compound onto a conductive base material to form a coating, drying this to form a film, heating this film to decompose it and then electrolysing the decomposed film.

MEDICAL AND DENTAL

Linkage of Platinum Drug to Nanoparticles

Brown Univ., *World Appl*. 2011/031,478

A Pt drug is linked to a Au-Fe_3O_4 NP which acts as a targeting agent. This is prepared by dissolving the L_1 molecule (see **Figure 1**) in water, PEG or DMF. The solution formed is then mixed with Au-Fe_3O_4 NPs in a ratio of ~1000:1 to ~10,000:1 for ≤ 6 h at ~4°C under protection from light and all free L_1 are removed.

Palladium Dental Alloys

Ceragem Biosys Co, Ltd, *World Appl*. 2011/046,274

A dental casting alloy can be machined by a CAD/CAM system. The alloy consists of (in wt%): 0.1–5 Au; 0–50 Pd; 25–50 In; 10–40 Ag; 0.1–0.3 Ir; and optionally 0.1–5 Pt. The advantages of this alloy are that it is corrosion resistant, fade resistant and biocompatible.

PHOTOCONVERSION

Blue Light-Emitting Iridium Complex in OLED

Gwangju Inst. Sci. Technol., *World Appl*. 2011/019,179

An OLED consists of two electrodes and a light-emitting layer stacked between these electrodes. A blue light-emitting Ir complex is situated in the light-emitting layer. This Ir complex contains ligands which have a low electron density structure such as triazole or tetrazole.

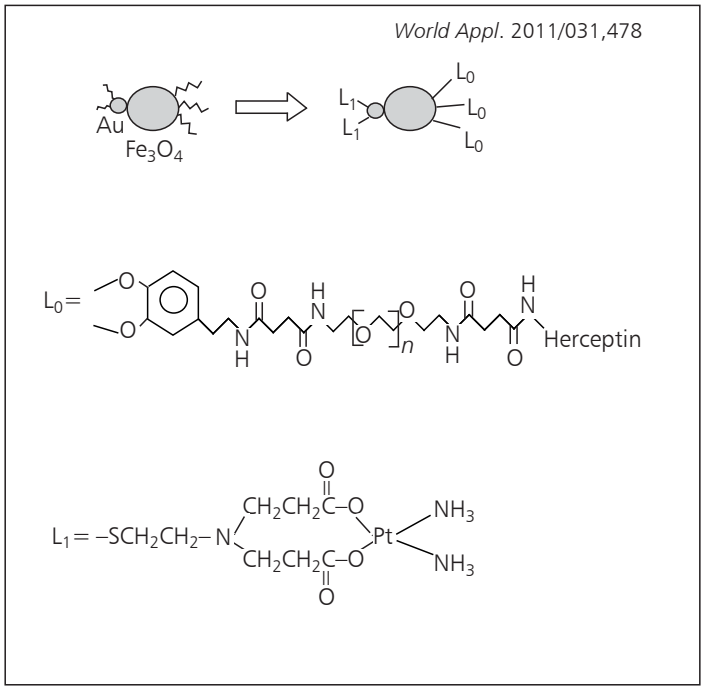

Fig. 1. Schematic illustration of a dumbbell-like Au-Fe_3O_4 nanoparticle coupled with an antibody and Pt drug complex for target-specific Pt drug delivery