

ELECTRICAL AND ELECTRONIC ENGINEERING

A Comparison of the Performance of Gold and Platinum Killed Power Diodes

S. D. BROTHERTON and P. BRADLEY, *Solid-State Electron.*, 1982, **25**, (2), 119-125

Measurement of leakage current, switching time and forward voltage drop are presented for Pt and Au killed diodes. Under specified conditions improved switching is obtained from Pt killed devices due to the life time profile produced at elevated temperatures by the shallow recombination centre.

Auger Electron Spectroscopy Analysis of the Contact Reaction of Pt-Si Codeposited Films and Silicon

M. EIZENBERG and R. BRENER, *Thin Solid Films*, 1982, **88**, (1), 41-48

Codeposited alloy films of Pt-Si on Si, used for the formation of shallow Schottky contacts, were studied by AES. The coat depth after annealing was larger than expected. An accumulation of Si and depletion of Pt in the outer 200-300Å of the film was also observed. Studies of the line shape for Auger transitions showed that the outer Si-rich region consists of a mixture of PtSi and elemental Si.

MEDICAL USES

High-Performance Liquid Chromatography Studies on Platinum Thymine Blue

J. D. WOOLLINS and B. ROSENBERG, *Inorg. Chem.*, 1982, **21**, (3), 1280-1282

Platinum thymine blue, PTB which has antitumour properties was examined by high-performance liquid chromatography. This revealed that typical preparations of PTB contain several colourless Pt compounds ("whites") as well as a number of blue species. This is the first time that the various blue components in PTB have been separated.

Osmium-Carbohydrate Polymers as Anti-Arthritic Drugs

C. C. HINCKLEY, J. N. BEMILLER, L. E. STRACK and L. D. RUSSELL, *Book of Abstracts*, 183rd Am. Chem. Soc. Natl. Meeting, Las Vegas, Na., 1982, Inorganic Paper 68

Osmium-carbohydrate polymers (osmarins) have been prepared and characterised, and are now being investigated as potential anti-inflammatory agents for some forms of arthritis. When dilute osmarin solutions are injected into the synovial space of a joint they bind irreversibly to articular cartilage and to the joint capsule.

NEW PATENTS

ELECTROCHEMISTRY

Recombination Device for Storage Batteries

ATOMIC ENERGY OF CANADA LTD.

British Appl. 2,084,388 A

The amount of H₂O lost in a recombination process is reduced by using a water-resistant PTFE supported platinised C catalyst which is not degraded when recombined H₂O is drained over the catalyst particles.

Platinum Metal Coated Electrodes

DIAMOND SHAMROCK CORP. *European Appls.* 46,447/9

A Ti or other valve metal substrate is coated with a platinum group metal or platinum group metal oxide coating by application of a dilute solution containing an Ir, Rh, Ru or other platinum group metal salt and HCl or another agent which will attack the Ti base.

New Ion Exchange Resins

HOECHST A.G.

European Appls. 47,945/50

New ion exchange resins are made from perfluorocarbonyl sulphonic acid fluorides which are obtained by the electrolysis of monohydroperfluoroalkane sulphonic halides against a Pt wire electrode. Os and Ir electrodes are also claimed.

Activated Cathode for Aqueous Solution Electrolysis

HODOGAYA CHEMICAL CO. LTD. *U.S. Patent* 4,300,992

An electrode which controls the amount of hypochlorous ion formed in electrolysis reactions and which has excellent corrosion resistance is made from a valve metal or alloy substrate, and an oxide coating containing a Ru, Rh, Pd, Os, Ir and/or Pt oxide.

Photochemical Electrode for Water Decomposition

NATIONAL RESEARCH DEVELOPMENT CORP.

U.S. Patent 4,305,794

A photochemical electrode which can decompose H₂O when irradiated with visible light is obtained by treating a Pt mesh with red mercuric sulphide blackened by iodide treatment.

Catalysed Chloralkali Cathode

JOHNSON MATTHEY & CO. LTD. *French Appl.* 2,480,795

A cathode for use in brine or H₂O electrolysis cells is made from an electrically conductive matrix carrying a surface deposit of a platinum group metal, Au or Ag catalyst, preferably Pt and/or Ru. The matrix may be made of Ni, Cu, austenitic steel or another base metal on to which the catalyst is deposited by chemical displacement.

ELECTRODEPOSITION AND SURFACE COATINGS

Electrodeposition of Ruthenium-Iridium Alloy

INCO EUROPE LTD. *European Appl.* 47,566

It has been found that valve metals such as Ti may be successfully plated with a Ru-Ir alloy from a bath which contains a soluble Ru compound, a soluble Ir compound, a soluble fluoroborate and acid.

Palladium Plating Bath

AMERICAN CHEMICAL & REFINING CO. INC.

U.S. Patent 4,297,179

A cyanide-free bath for producing bright, adherent Pd coatings at a wide range of current densities contains a 3-butyn-2-ol brightener.

LABORATORY APPARATUS AND TECHNIQUE

Analyser for Determining the Organic Carbon Content of Solids

PERKIN-ELMER CORP. *European Appl.* 46,178

One portion of the sample is introduced into a Pt vial together with an acidic fluid, such as phosphoric acid, and the results obtained from analysing the content of the vial in a single channel elemental analyser are compared with a second portion of the test material introduced directly into the analyser.

Microminiative Palladium Oxide Gas Detector

A-T-O INC. *U.S. Patent* 4,296,399

A zero-stable combustible gas detector is made by winding a thin (0.0001–0.005 cm) Pd or Pt wire about a Mo mandrel, coating the wound wire with a binder, of, for example, reduced chromic and phosphoric acids, and after curing the binder, coating it with a Pd oxide catalyst.

Hydrogen Gas Detector

BABCOCK & WILCOX CO. *U.S. Patent* 4,298,574

A differential thermocouple H_2 gas detector is provided by coating one thermocouple junction with a Pd-Ag alloy catalyst and the other junction with a non-catalyst. Heated H_2 reacts with the catalyst to heat the junction and hence to cause an e.m.f. proportional to the amount of H_2 in the gas.

Catalytic Gas Sensor

DIFFRACTO LTD. *U.S. Patent* 4,303,612

Pellistor type detectors for measuring the amount of CH_4 present in air are prepared by applying Al_2O_3 (particle size below 100 Å) on to a Pt filament and then impregnating a Pt or Pd catalyst on to the dried Al_2O_3 coating. The Pt wire is stabilised before being coated with the Al_2O_3 via an Al layer obtained by the electrical decomposition of an Al salt.

Soot Detector for Monitoring Diesel Exhausts

ROBERT BOSCH G.M.B.H. *U.S. Patent* 4,307,061

A sensor for detecting soot and free C consists of two Pt-5%Al oxide electrodes separated by a narrow (0.1 mm) high resistance support of, for example, Al_2O_3 . Deposition of soot upon the electrodes causes the resistance between the electrodes to drop and a catalyst layer, such as small amounts of Pt in a base metal oxide matrix of Al_2O_3 , is used to oxidise the deposited soot after measurement has taken place.

HETEROGENEOUS CATALYSIS

Isothermal Methanation – II

JOHNSON MATTHEY & CO. LTD.

British Patent 2,008,147 B

Improved conversion rates may be obtained from a highly exothermic methanation process in which synthesis gas is converted in the presence of a supported catalyst of Pt, Pd, Rh, Ir, Ru, Fe, Co, Ni, Cu, W, and their alloys if gases leaving the converter are brought into contact with high surface area bodies having cooling liquid sprayed over their contact surfaces. The preferred catalyst is Ru and/or Ni in a support, such as pellets or a honeycomb monolith.

Liquid Hydrocarbon Synthesis from Coal

SHELL INTERNATIONAL RESEARCH MIJ. B.V.

British Patent 2,009,778 B

Ru Fischer-Tropsch catalysts may be used in a three stage process for preparing high octane petroleum products from coal. Coal is gasified to a mixture of CO and H_2 and this mixture is converted to hydrocarbons over a crystalline Fe silicate catalyst. An isobutane fraction is alkylated to obtain a gasoline fraction which is mixed with a second gasoline fraction obtained from the hydrocarbon mixture.

Platinum or Palladium Catalyst for a Laser

SECRETARY OF STATE FOR DEFENCE

British Appl. 2,083,944 A

The lasing medium of a CO_2 (- N_2 -He) laser is brought into contact with an Al-containing ferritic steel supporting a Pt or Pd catalyst in order to convert any CO present to CO_2 and to alleviate degradation of the laser caused by CO_2 breakdown by the electrical discharge.

Platinum Metal-Phosphinopolymer Catalysts

DEGUSSA A.G.

British Appl. 2,084,166 A

Polymeric complex compounds of Rh, Ir or Ru have a SiO_2 -like structure where the platinum group metal is bonded via phosphine groups to an insoluble, silicone, cross-linked polycondensate. A typical metallopolymer is obtained from $RhCl_3$ and a phosphinosiloxane, $PhP[(CH_2)_3Si(OEt)_3]_2$. The products may be used as heterogeneous catalysts for a variety of reactions.

Unsaturated Carboxylic Acid Production

WACKER-CHEMIE G.M.B.H. *European Appl.* 48,946

Unsaturated acids are obtained in improved yields when olefins are reacted with O₂ and a carboxylic acid in the presence of a Group VIII catalyst, an acetate and 1–8000 ppm of an organic chlorocompound. In one example the catalyst consists of bentonite carrying 2.2% Pd, 1.9% K, 1.7–1.9% Cd and 0.07% Mn.

Zirconia-Alumina Supported Iridium Reforming Catalyst

STANDARD OIL CO. (INDIANA) *U.S. Patent* 4,297,205

A catalyst especially suitable for reforming naphthas consists of Ir (0.05–1.5%) supported on an Al₂O₃ carrier containing either 3–15% ZrO₂ or more than 60% ZrO₂.

Platinum-Rhenium Hydrocarbon Conversion Catalyst

STANDARD OIL CO. (INDIANA) *U.S. Patent* 4,298,461

A platinum group metal catalyst, such as platinum deposited on a composite consisting of Al₂O₃ and Re deposited on SiO₂ may be used without the conventional pre-sulphiding treatment and does not suffer any loss of reforming performance.

Acidic Multimetallic Reforming Catalyst

U.O.P. INC. *U.S. Patent* 4,298,462

A catalyst especially suitable for dehydrocyclising 6–10C paraffins contains 0.01–2% of a platinum group metal, 0.05–5% Ni, 0.01–5% Zn and 0.1–3.5 of a halogen component.

Catalytic Combustion in Boilers

JOHNSON MATTHEY & CO. LTD. *U.S. Patent* 4,299,192

Combustion within a boiler takes place in at least two stages with heat extraction between the stages in order to reduce the temperature of the reactor to one which conventional catalysts and supports will withstand. The O₂ content of the final stage is preferably reduced to zero and catalysts used in the reactor are FeAlCrY alloy-supported platinum group metals with an intermediate layer of Al₂O₃.

Palladium-Copper Catalyst for Ether Preparation

PHILLIPS PETROLEUM CO. *U.S. Patent* 4,299,998

Ethers may be prepared from olefins and alcohols under relatively mild conditions when a catalyst containing Pd, Cu, a Group IA or IIA metal halide and optionally a surfactant component is used.

Catalytic Cracking

STANDARD OIL CO. (INDIANA) *U.S. Patent* 4,300, 997

Small amounts of Pd and Ru, in a Pd : Ru ratio of 0.1 : 1 to 10 : 1, enhance the combustion of CO within the regeneration zone of a catalytic cracking unit without causing excess formation of NO_x. The Pd-Ru promoter also enhances the capture of SO_x by suitable absorbents within the regeneration zone.

Methanation Process

UNION OIL CO. OF CALIFORNIA *U.S. Patent* 4,302,219

A catalyst for producing fuel gas from synthetic or natural hydrocarbon feedstocks consists of an interspersed mixture of Group IVB, VB or VIB metals in combination with Group VIII metals supported on an inorganic oxide carrier having specified pore and volume characteristics. A preferred catalyst contains Pt, Ni and Cr.

Photocatalytic Decarboxylation of Saturated Carboxylic Acids

UNIVERSITY OF TEXAS *U.S. Patent* 4,303,486

The heterogeneous photocatalytic decarboxylation of saturated carboxylic acids on to various n-type semiconductor powders may be carried out using platinumised anatase catalysts.

Diesel Exhaust Purification Catalyst

W. R. GRACE & CO. *U.S. Patent* 4,303,552

A catalyst is formed from a mixture of Al₂O₃ or ZrO₂-supported Pt or Pd and/or Cr oxide together with a bulk material of Ag and/or Hf which effectively catalyses the combustion of C particles.

Platinum Catalysts for Boiler Gas Exhaust Treatment

EXXON RESEARCH & ENGINEERING CO. *U.S. Patent* 4,303,625

Steam boiler exhausts are used to maintain the gas volume in an oil reservoir but there is a need to remove corrosive materials present in the exhausts. This is now accomplished by means of a Group VIII metal, especially a Pt catalyst, supported on a low acidity Al₂O₃ base.

Conversion of Butane to Petrol

U.O.P. INC. *U.S. Patent* 4,304,948

A multi-step hydrocarbon conversion process for producing petroleum fractions from butane includes dehydrogenation of the butane over Pt and/or Pd.

Nonacidic Multimetallic Dehydrogenation Catalyst

U.O.P. INC. *U.S. Patent* 4,304,950

An active, selective, stable catalyst for hydrocarbon dehydrogenation contains 0.01–2% of a platinum group metal—Pt, Ir, Rh or Pd; 0.05–5% Co; 0.01–5% Ta and 0.1–5% of a Group IA or IIA metal.

Stabilised Platinum-Rhenium Reforming Catalyst

ATLANTIC RICHFIELD CO. *U.S. Patents* 4,305,810/1

The thermal stability of halided Pt-Re catalysts is improved by using an Al₂O₃ support which has been prepared from at least 75% boehmite having an average crystallite diameter no more than 60Å. The thermal stability may be further improved by adding a low-Na colloidal SiO₂ dispersion to a mull of Al₂O₃ prior to its extrusion and calcination.

Preparation of Acetaldehyde

RHONE-POULENC INDUSTRIES *U.S. Patent* 4,306,091

The addition of small amounts of Ru to a catalyst system having a low Co content considerably improves the selectivity and production rates for the preparation of acetaldehyde by the carbonylation of methanol.

Turbocharged I.C. Engines

JOHNSON MATTHEY & CO. LTD. *French Appl.* 2,479,323

The exhaust from turbocharged engines contains particles of hydrocarbons, C and other solids. These are now eliminated by catalytic oxidation in a special chamber. In one example a 94.3Pt-5.7%Rh catalyst layer is deposited on washcoated stainless steel wire.

Platinum Metal Hydrocarbon Conversion Catalysts

STE. FRANCAISE DES PRODUITS POUR CATALYSE

French Appl. 2,481,144

Catalysts which may be used in severe conditions contain 0.05–0.6% of a platinum group metal (Pt or Ir); 0.05–5% Bi; 0.005–5% of Zn and/or Pb; and 0.1–15% of a halogen component.

Propylene Hydroformylation

BASF A.G. *German Offen.* 3,102,281

In a combined process of improved efficiency, effluent gases from the high-pressure hydroformylation of propylene in the presence of a Co catalyst are reacted further at a lower pressure in the presence of a Rh catalyst.

Platinum Group Metal and Base Metal Catalysts—Lead Tolerant

JOHNSON MATTHEY & CO. LTD.

German Offen. 3,108,922

An oxidation catalyst for exhaust gas treatment consists of one or more platinum group metals and a base metal component deposited on a surface coated with a refractory oxide, for example an Al₂O₃-coated ceramic or metallic monolith. Suitable base metal components are SnO₂, WO₃, TiO₂ and/or NiMoO₄. The catalyst has improved poison resistance.

HOMOGENEOUS CATALYSIS

Ethylene Glycol Continuous Production

UNION CARBIDE CORP. *European Appl.* 48,980

Glycol and ethanol are produced from H₂ and CO in a continuous process using a solubilised Ru carbonyl catalyst, such as Ru acetylacetonate reacted with CO.

Selective Ethanol and Methanol Production from Synthesis Gas

UNION CARBIDE CORP. *U.S. Patent* 4,301,253

A homogeneous Ru catalyst used in conjunction with a halogen promoter and an organic phosphine oxide compound is used for the synthesis of ethanol and methanol from synthesis gas under mild conditions.

Platinum-Catalysed Organosilicon Conductive Polymers

TOSHIBA SILICONE CO. LTD. *U.S. Patent* 4,303,572

Poor curing rates obtained from silicone elastomer compositions containing W or Ag conductive particles are overcome by using a Pt catalyst such as Pt[P(OPh)₃]₄, Pt[P(OBu)₃]₄ and Pt[PPh₃]₄.

Ruthenium Carbonyl Oxo Catalyst

UNIVERSITY OF TEXAS *U.S. Patent* 4,306,084

A method for producing specific isomers of the next higher normal alcohol from the reaction of an olefin in an oxo process uses a Ru carbonyl catalyst, especially Ru(CO)₁₂.

ABS Polymer Hydrogenation

JOHNSON MATTHEY & CO. LTD.

German Offen. 3,107,084

The hydrogenation of an unsaturated organic material by contact with gaseous or dissolved H₂ is enhanced by using the material in the form of an emulsion. Suitable catalysts are Rh-phosphine arsine or stibine complexes, for example (Ph₃P)₃RhCl. Using this method the susceptibility of certain polymers to oxidative degradation is contained.

FUEL CELLS

Fuel Cell Electrocatalyst

HITACHI LTD. *European Appl.* 47,322

A 'Raney type' method is used to produce fine metal particles having a large surface area, especially Pt black particles, suitable for use in fuel cell electrodes, for example. A solution containing Pt (or the other metal required) and at least one other metal ion, with redox potential different to Pt, is reduced and the second metal is removed from the particles by elution. The second metal may be Pd.

Gas Diffusion Electrode

ASAHI GLASS CO. LTD. *U.S. Patent* 4,299,682

A gas diffusion-electrode, for use in brine electrolysis and in the oxidiser side of a fuel cell having high performance, has a porous layer prepared by sintering a mixture of catalysts, especially Pt, Pd and Raney Ag, hydrophobic material, filler and, as a pore forming agent, a Ni, Co or Fe carboxylate salt.

CATHODIC PROTECTION

Two Piece Electrical Connector for Cathodic Protection Systems

IMI MARSTON LTD. *British Patent* 2,001,807 B

Connector systems which may be connected and disconnected under salt water are made of Nb or another valve metal and have their contact surfaces coated with a platinum group metal or platinum group metal oxide. The two parts may be joined by screw threading or by bolting together spade portions. The connectors are used for oil rigs.

GLASS TECHNOLOGY

Glass Fibre Bushing

OWENS-CORNING FIBERGLAS CORP.

U.S. Patent 4,303,429

The base plate of the bushing is made from a porous material, such as sintered Pt-Rh powder, diffusion bonded Pt-Rh wire cloth or foamed Pt-Rh alloy. It has elongated rods, also of Pt-Rh alloy, projecting downwards from the base plate, to prevent flooding beneath the base plate.

ELECTRICAL AND ELECTRONIC ENGINEERING

Resistive Material and Electrocatalyst

EXXON RESEARCH & ENGINEERING CO.

European Appl. 46,053/4

New pyrochlore materials for use in electrical and electronic circuits have the composition $A_xB_{2-x}A_yO_{7-y}$, where A is Pb and/or Bi, B is Ru and/or Ir, and x and y are up to 1.0. Ru and Pb are a preferred combination. In *European Appl. 46,054 A* may be Tl for electrocatalysts in organic oxidation.

Metal Silicide Film on Silicon

I.B.M. DEUTSCHLAND G.M.B.H. *European Appl. 48,291*

A mask for an electron or X-ray beam has an opening of pyramidal shape made in a flat Si body and a coating of metal silicide. The metal may be Ir, Pt or Pd, for example.

Bismuth Strontium Rhodate Resistance Material

U.S. PHILIPS CORP.

U.S. Patent 4,301,042

$Bi_xSr_{1-x}Rh_{2.5}O_{5-5.5}$ resistance materials, where x is 0-0.5, may be used together with a glass frit binder and a temporary binder to produce positive TCR resistances having short firing times.

Fabrication of Emitter Regions of Integrated Circuits

INTERNATIONAL BUSINESS MACHINES CORP.

U.S. Patent 4,301,588

Ion implantation via a sputtered amorphous Si buffer layer allows precise shallow emitter regions to be obtained. The depth of the n-type region is thinned to a single crystal surface by consuming the polysilicon partly through oxidation and partly by conversion to Pt silicide contacts.

Stable, Pyrochlore Resistor Materials

E. I. DU PONT DE NEMOURS & CO.

U.S. Patent 4,302,362

Stable thick film resistor compositions contain 20-75 parts of a pyrochlore having the formula $(M_xBi_{2-x})(M'M''_{2-y})O_{7-y}$, where M is Y, Th, In, Cd, Pb, Cu and/or a lanthanide metal, M' is Pt, Rh, Ti, Cr and/or Sb, and M'' is Ru and/or Ir. Preferred compositions are $Bi_2Ru_2O_7$ and $Pb_2Ru_2O_6$.

Ruthenium-Tipped Reed Contacts

BELL TELEPHONE LABORATORIES INC.

U.S. Patent 4,307,360

Ru coatings (0.5-1.5 μ m thick) on Cu reed contacts have reduced erosion and sticking failure.

TEMPERATURE MEASUREMENT

Thermocouple Cold Junction

B. GREGSON

British Appl. 2,082,774 A

A network having a number of temperature sensitive elements, such as Pt resistors, is used to simulate the cold junction output of a thermocouple, which may be Pt : Pt-Rh or a base metal couple.

Resistance Thermometer

LINDE A.G.

German Offen. 3,022,942

A thermometer of improved design for measuring temperatures up to 400K includes elements of C and spectrally pure Pt.

MEDICAL USES

Tobacco Composition Including Palladium

LIGGETT GROUP INC.

British Appl. 2,082,438 A

An aqueous solution of a Pd compound is mixed with a reducing agent to deposit highly active Pd on tobacco products. Sugars are the preferred reducing agents. The Pd reduces the biological activity of the tobacco smoke.

Vinyl Silicone Mass for Tooth Moulding

BAYER A.G.

European Appl. 46,907

Pd or a Pd alloy is deposited on a zeolite and added to a catalysed and filled vinyl silicone paste for moulding teeth in order to absorb any H_2 generated. The curing catalyst itself may contain a Pt complex.

Metal Chelate Anticancer and Dye Compounds

AMERICAN CYANAMID CO.

U.S. Patent 4,296,030

Pt and other transition metal chelates of symmetrical bis(substituted amino)dihydroxy-anthraquinones possess anti-tumour activity.

Perfusate Redox Potential Controller

ST. LOUIS UNIVERSITY

U.S. Patent 4,299,919

Pt electrodes and Ag/AgCl reference electrodes are used in a redox controller fitted in an apparatus which preserves human organs for transplantation.

Platinum Complex for Cancer Treatment

SANOFI

French Appl. 2,481,289

A complex of improved water-solubility, for the treatment of tumours, is *cis*-isocitrate(1,2-diaminocyclohexane)platinum.