

## ELECTRICAL AND ELECTRONIC ENGINEERING

### Investigation of Electrolytically Deposited Ohmic Contacts of Palladium on Silicon

A. P. DOSTANKO, G. V. DUDKO, V. I. MAKHOV and O. V. MITROFANOV, *Zh. prikladnoi Khim.*, 1969, **42**, (5), 1109-1113

Pd, electrodeposited on p- and n-type Si with specific resistance 0.0004-20.0 ohm.cm, forms ohmic contacts with linear voltage current characteristics. Deposits adhere well and consist uniformly of fine crystals. Factors which reduce

the resistance of the ohmic contacts are decreasing the specific resistance of the Si, the separation of the blocks and the voltage of the latter.

### Platinum-base Alloys for Elastic-sensitive Elements of Electrical Measuring Instruments

S. N. PAVLOVA, *Izv. Vysshikh Ucheb. Zaved., Tsvet. Metall.*, 1969, **12**, (2), 132-134

Tests on various Ag-Pd-Pt alloys showed that 20% Ag-10% Pd-Pt is better than any other tested for elastic-sensitive elements of electrical instruments. It is superior to 20% Ag-Pt used hitherto in its physical and mechanical properties.

## NEW PATENTS

### METALS AND ALLOYS

#### Improvements in and Relating to Alloys Containing Platinum Group Metals

JOHNSON MATTHEY & CO. LTD

*French Patent 1,570,312*

The alloys contain at least one of the Pt metals, especially Rh, Ir, Pt and Pd, and up to 20% of one of the transition elements Sc, Ti, V, Y, Zr, Nb, Hf, Ta or a lanthanide. The Pt metal is melted under inert conditions, the apparatus is evacuated, the transition element is added, and the alloy is cast.

(e.g. Fe, Co, Ni, Mn, etc.) dried and heated at 500-1,500°C to produce an intimate mixture of Pt and the second metal. A major amount of the second metal is then removed to increase the internal surface area of the electrode.

#### Reference Electrode

JENAER GLASWERK SCHOTT & GEN.

*German Patent 1,498,827*

An electrode for electrochemical potential measurements is equipped with a noble metal diaphragm, e.g., a Pt sintered diaphragm.

### CHEMICAL COMPOUNDS

#### Preparation of Palladium Sulphate Solution

DOW CHEMICAL CO.

*U.S. Patent 3,425,801*

Metallic Pd is contacted with aqueous H<sub>2</sub>SO<sub>4</sub> (concentration 9-60 wt%) at 80-150°C in the presence of O<sub>2</sub> to yield stable aqueous solutions of Pd sulphate.

### ELECTRODEPOSITION AND SURFACE COATINGS

#### Coating of Refractory Materials

JOHNSON MATTHEY & CO. LTD

*British Patent 1,150,074*

A protective metallic coating is applied to a refractory material by introducing the latter (below 400°C) into an atmosphere of vaporised Pt group metal oxide (or other reducible compound) maintained at about 1400°C. A coating of the reducible compound is deposited on the material and this is reduced to metal by further heat treatment. In preferred embodiments the oxide is PtO<sub>2</sub>.

#### Manufacture of Palladous Halide

FARBWERKE HOECHST A.G.

*U.S. Patent 3,427,123*

Metallic Pd having a large surface area is treated with O<sub>2</sub> in the presence of carboxylic acids, metal halide and ammonium halide to produce palladous halides.

#### Metal Plating Polymers

TOKYO SHIBARA ELECTRIC CO. LTD

*British Patent 1,155,257*

Polymer articles are roughened by bombarding them with activated ions generated by glow discharge. The roughened surface is immersed in aqueous solutions of HCl/SnCl<sub>2</sub> and HCl/PdCl<sub>2</sub>. The Pd is electrolessly plated on the surface and subsequently electrolytically plated on the coated surface.

### ELECTROCHEMISTRY

#### Improved Platinum Electrode

STANDARD OIL CO.

*U.S. Patent 3,429,750*

An electrically conducting inert support is impregnated with salts of Pt and a second metal

## Deposition of Platinum-Carbon Films

VICTORY ENGINEERING CORP.

*U.S. Patent 3,428,541*

An electrically resistive film is produced by striking an arc between a Pt/C electrode and a counter-electrode to produce a vaporised mixture of Pt and C which is condensed on the substrate. Other Pt group metals can be used in the films.

## Composite with a Platinum Coating

OWENS-ILLINOIS INC. *U.S. Patent 3,432,278*

A corrosion-resistant metal article comprises a base metal (Fe, Ni, etc.), a thin intermediate layer of an easily reduced metal (Cu, Ag or Au) and an outer layer of Pt. The latter is applied in molten droplet form using a plasma jet or by flame spraying.

## Lamination of Copper to Noble Metals

JOHNSON MATTHEY & CO. LTD

*French Patent 1,550,563*

Cu and its alloys are laminated or coated with noble metals in sheet form (e.g. Pd) using an intermediate layer of Ni, Co, Fe, Mo, or V.

## Electrodeposition of Palladium

JOHNSON MATTHEY & CO. LTD

*Canadian Patent 809,643*

The electrolyte is an alkaline or neutral aqueous solution of a Pd compound and an  $\text{NH}_4$  salt of a weak acid which does not form an insoluble product with the Pd compound. This corresponds to *French Patent 1,436,451*.

## JOINING

### Refractory Metal-to-Ceramic Seal

PHILIPS ELECTRONIC & ASSOCIATED INDUSTRIES LTD

*British Patent 1,151,473*

A refractory ceramic body is bonded to a refractory metal surface by forming a tightly adherent non-porous layer of Mo and/or W on a portion of the surface of the ceramic, then bonding the refractory metal surface to the coated surface by means of a refractory metal wetting agent and a brazing metal. The wetting agent is a Rh-Mo or Ru-Mo alloy capable of wetting the non-porous layer.

## HETEROGENEOUS CATALYSIS

### Platinum Metal Catalysts

E. I. DU PONT DE NEMOURS & CO.

*British Patent 1,150,380*

A catalyst composition comprises a Pt group metal on a carrier. The carrier is hydroxy carbonate of a rare earth metal. The  $\text{CO}_3^{2-}$  content of the latter is 20–95% of that for the neutral rare earth carbonate. Alternatively the carrier may be a mixture of a lanthanide oxide with a lanthanide carbonate. The latter is

5–80% of the stoichiometric amount reckoned on the neutral lanthanide carbonate. Preferred embodiments are Ru on  $\text{CeO}_2$  containing Ce carbonate.

### Palladium Catalysts

STANDARD OIL CO.

*British Patent 1,150,422*

A Pd/C catalyst is brought into contact with liquid  $\text{HCOOH}$  at a temperature of at least  $100^\circ\text{F}$ , for the purpose of controlling its activity. The activity of the catalyst may have been reduced by contacting with terephthalic acid and 4-carboxybenzaldehyde in the presence of  $\text{H}_2$ . The catalyst is for the purification of aromatic polycarboxylic acid.

### Production of Adiponitrile

BADISCHE ANILIN- & SODA-FABRIK A.G.

*British Patent 1,151,567*

Adiponitrile is continuously produced by liquid-phase hydrogenation of 1,4-dicyanobutenes at  $50\text{--}200^\circ\text{C}$  using a Pd catalyst comprising Pd and Ag as oxides or metals. The catalyst may also contain Ni, Co, V, Mn as oxides or metals. In an example the catalyst was composed of 0.3% Pd, 5% Ag, 1% Mn on hardened silicic acid pellets.

### Catalysts

TEXACO DEVELOPMENT CORPORATION

*British Patent 1,152,536*

A chlorinated hydrocarbon activated  $\text{Pt}/\text{Al}_2\text{O}_3$  composite is dynamically stabilised by (a) heating ( $600\text{--}1200^\circ\text{F}$ ) in the presence of a non-reactive gas at prescribed flow rate; (b) adjusting the gas temperature to  $150\text{--}700^\circ\text{F}$ ; (c) contacting the composite ( $150\text{--}700^\circ\text{F}$ ) with a compound selected from  $\text{CCl}_4$ ,  $\text{CHCl}_3$ ,  $\text{CHCl}_2$  or trichloroacetylchloride or in an  $\text{O}_2$  atmosphere with an organic chloride.

### Dimerisation of Olefins

INSTITUT FRANCAIS DU PETROLE DES CARBURANTS

ET LUBRIFIANTS

*British Patent 1,153,519*

Olefins are dimerised in the presence of a catalyst which consists of an organo Al compound (e.g.  $\text{AlEtCl}_2$ ), and a halide of a precious metal (Pt, Ir, Rh or Pd). The catalyst is associated with a binder, e.g. S, an arsine, a phosphine or a stibine.

### Reforming Aromatisation Process

ESSO RESEARCH & ENGINEERING CO.

*British Patent 1,153,920*

A hydrocarbon feedstream is reformed by contacting it with a catalyst consisting of a metal of the Pt-group (e.g. Pt) carried on a refractory support. There are a number of catalyst zones. The catalyst in the tail zones is sulphided to the extent of 0.01–2.0 wt% of the total.

### Unsaturated Esters

STAMICARBON N.V.

*British Patent 1,154,517*

Saturated organic carboxylic acids and olefines

are reacted with  $O_2$  in the gas phase in contact with a Pd catalyst to yield unsaturated esters. The catalyst comprises a carrier material bearing Pd and one or more of Pt, Rh, Ru. The ratio of Pd to the other noble metal(s) is in the range 300:1 to 3:1.

### Hydrocarbon Conversion Catalyst

TEXACO DEVELOPMENT CORP.

British Patent 1,155,516

A hydrocarbon conversion catalyst consists of  $Al_2O_3$ , 0.01–2% of Ru, Rh, Pd or Pt and 3–15% Cl and/or Br. A composite of the metal and  $Al_2O_3$  is contacted with the halogen and one or more organic compounds (e.g. chloral,  $C_2Cl_4$ ) at 200–800°F.

### Phenylacrylonitriles

ASAHI KASEI KOGYO K.K. British Patent 1,156,620

Phenylacrylonitriles are produced by subjecting a gaseous mixture of styrene (or a styrene derivative), HCN and  $O_2$  (or air) to a catalytic reaction (100–500°C) in the presence of Pd, Rh, or a Pd or Rh compound. In examples  $PdCl_2$  is the preferred catalyst, supported on  $SiO_2$  and possibly treated with  $H_2S$  prior to the synthesis reaction.

### Oxidation Catalyst

ETHYL CORP.

U.S. Patent 3,425,792

ICE exhaust gas is oxidised on a supported Pt catalyst promoted with a Pb compound. The catalyst is produced by digesting  $Al_2O_3$  in  $H_3PO_4$ , adding Pb oxide and  $PtCl_2$  and calcining.

### Catalytic Hydrogenation

UNIVERSAL OIL PRODUCTS CO.

U.S. Patent 3,426,090

An aromatic compound, e.g. a benzene hydrocarbon is hydrogenated at 10–425°C at 1–200 atm, in contact with a group VIII metal (e.g. Pt) deposited on a refractory oxide support and chemically treated with a subfluoride vapour.

### Catalyst Preparation

UNIVERSAL OIL PRODUCTS CO.

U.S. Patent 3,428,572

Inorganic oxide support material (e.g.  $Al_2O_3$ ) is mixed with a soluble compound of a catalytically active metal (e.g. Pt) and a soluble thioamide, mercaptocarboxylic acid or other S compound and treated to gel the inorganic oxide hydrosol.

### Production of Acrolein and Methacrolein

SUN OIL CO.

U.S. Patent 3,428,686

$C_3H_6$  and isobutylene are reacted with air or  $O_2$  in the presence of a Pt catalyst metallic gauze at temperatures of 750–1000°C to yield aldehydes.

### Normal Mono-olefines by Dehydrogenation

UNIVERSAL OIL PRODUCTS CO.

U.S. Patent 3,429,944

6–20 C normal mono-olefines are produced by

contacting the corresponding normal paraffin with a non-acidic Pt/ $Al_2O_3$  catalyst in dehydrogenation conditions. The particle size of the catalyst should not be greater than 1/32 inch.

### Molecular Rearrangement of Cycloalkadiene Compounds

UNIVERSAL OIL PRODUCTS CO.

U.S. Patent 3,432,564

Cyclodecadiene rearranges to 1, 2-diethyl cyclohexane (among other things) on treatment with  $H_2$  in contact with a catalyst obtained by commingling  $Al_2O_3$  spheres carrying a Pt compound and thiomalic acid.

### Catalytic Hydrogenation

SHELL OIL CO.

U.S. Patent 3,432,565

The catalyst for high temperature hydrogenation of aromatic hydrocarbons is 0.3–3% Pt/ $Al_2O_3$  with a low bulk density (<0.70 g/ml).

### Cis-Cyclodecene

UNIVERSAL OIL PRODUCTS CO.

U.S. Patent 3,433,842

Trans, cis-1, 5-cyclodecadiene is converted to cis-cyclodecene by contacting it with a Pd hydrogenation catalyst with an amine present to suppress side reactions. See also U.S. Patent 3,433,843.

### Catalytic Reforming

CHEVRON RESEARCH CO.

U.S. Patent 3,434,960

Naphtha is reformed in contact with a catalyst consisting of a porous oxide carrier bearing 0.01–1.0 wt% Pt and 0.01–2 wt% Re. See also U.S. Patent 3,438,888.

### Dealkylation of Alkyl Substituted Aromatics

UNIVERSAL OIL PRODUCTS CO.

U.S. Patent 3,436,433

A catalyst for the dealkylation of alkyl substituted aromatic hydrocarbons consists of a Rh–Fe–alkali metal– $Cr_2O_3$ – $Al_2O_3$  composite, the alkali metal being K. See also U.S. Patent 3,436,434.

### Removal of Oxygen from Closed Containers

UNIVERSAL OIL PRODUCTS CO.

U.S. Patent 3,437,425

$O_2$  is removed from closed containers by admitting  $H_2$  and contacting the gaseous mixture with a catalyst prepared by impregnating a support ( $Al_2O_3$ ) with a Pd– $Cl_2$  solution (Cl:Pd mol. ratio is 6:1 to 10:1) and thereafter drying and reducing the impregnated support. See also U.S. Patents 3,437,426–3,437,428.

### Preparation of Acetaldehyde

FARBWERKE HOECHST A.G.

U.S. Patent 3,439,044

$C_2H_4$  is oxidised to  $CH_3CHO$  in the presence of

H<sub>2</sub>O and metallic Pd. The text discloses the use of metallic Pt metals generally on inorganic supports such as Al<sub>2</sub>O<sub>3</sub>.

### Catalytic Dehydrogenation of Paraffins

SHELL OIL CO. *U.S. Patent 3,439,061*  
Olefines are produced by the dehydrogenation of paraffins over sulphided Group VIII metal catalysts, e.g. Pt/Al<sub>2</sub>O<sub>3</sub> with S added to the feedstock to maintain the S content.

### Isomerisation Catalyst

TEXACO INC. *U.S. Patent 3,440,300*  
A Pt/Al<sub>2</sub>O<sub>3</sub> catalyst activated by a halogenated hydrocarbon is stabilised by heat treatment in the presence of a non-reactive gas (N<sub>2</sub>, air, O<sub>2</sub>, He) and contacting (150–700°F) with either an organic chloride containing at least 2 C atoms, in an O<sub>2</sub> atmosphere and with CCl<sub>4</sub>, CHCl<sub>3</sub>, COCl<sub>2</sub>, CH<sub>2</sub>Cl<sub>2</sub> or CCl<sub>3</sub>COCl. This provides a stabilised catalyst of Cl content 3–10%. See also *U.S. Patent 3,440,301*.

### Isomerisation Catalyst

GULF RESEARCH & DEVELOPMENT CO.  
*U.S. Patent 3,441,514*  
A Pt/Al<sub>2</sub>O<sub>3</sub> composite catalyst is contacted with a S chloride and an O<sub>2</sub>-containing gas under non-reducing condition at 750–1100°F. Alternatively the activation may be carried out by contacting with a gaseous halogen and an O<sub>2</sub>-containing gas at 750–1100°F prior to contacting with SCl<sub>2</sub>.

### Vinyl Acetate

KNAPSACK A.G. *U.S. Patent 3,441,601*  
Vinyl acetate is produced by the vapour phase reaction of C<sub>2</sub>H<sub>4</sub>, CH<sub>3</sub>COOH and O<sub>2</sub> on a catalyst (Pd on an inert carrier) activated by exposure to air and N<sub>2</sub>. Fresh catalysts are first subjected to air at elevated temperatures and pressures and then to N<sub>2</sub>.

### Hydrogenation Isomerisation

PHILLIPS PETROLEUM CO. *U.S. Patent 3,441,624*  
Aromatic hydrogenation and cycloparaffin isomerisation are effected simultaneously in contact with a Group VIII metal catalyst (Pt) on halogen-treated Al<sub>2</sub>O<sub>3</sub> at 150–275°F, 50–1500 psig and specified space velocity and H<sub>2</sub> feed rate.

### Selective Catalytic Hydrogenation of Crotonaldehyde

JOHNSON MATTHEY & CO. LTD  
*Swiss Patent 467,229*  
C<sub>3</sub>H<sub>7</sub>CHO is produced by the hydrogenation of crotonaldehyde in the liquid phase using a Pd metal catalyst deposited on a support, preferably Al<sub>2</sub>O<sub>3</sub>, C or a ceramic material. This corresponds to *British Patent 1,089,835*.

## HOMOGENEOUS CATALYSIS

### Polysiloxane-Polyoxyalkylene Block Copolymers

RHONE-POULENC S.A. *British Patent 1,151,960*  
New block copolymers are produced by reaction of linear polysiloxanes with polyalkylene-glycol monoethers. The reaction of Si-H bonds with the alcohols requires a catalyst, preferably Pt, Pt black or H<sub>2</sub>PtCl<sub>6</sub>. The acid is preferred.

### Production of Unsaturated Esters

IMPERIAL CHEMICAL INDUSTRIES LTD  
*British Patent 1,154,039*  
An olefin and O<sub>2</sub> are contacted with a solution consisting of a Pd (II) salt, a carboxylic acid, halide ions, carboxylate ions, a Cu salt and an inorganic redox system of specified E°.

### Hydrogenation Process

IMPERIAL CHEMICAL INDUSTRIES LTD  
*British Patent 1,154,937*  
Unsaturated organic substrates are hydrogenated in homogeneous liquid media by contacting with H<sub>2</sub> in the presence of a zero valent Pt or Pd compound containing one or more ligands derived from organic substituted phosphines. Compounds exemplified include bis(triphenylphosphine)(acetylene)Pt(O) and tetrakis(triphenylphosphine)-Pd.

### Oligomerisation of Olefines

IMPERIAL CHEMICAL INDUSTRIES LTD  
*British Patent 1,155,003*  
Mono-olefines are oligomerised in a solution of a Rh or Ru salt (e.g. chloride) in a hydrocarbon containing H<sub>2</sub>O. Co-ordinating ligands (e.g. Ph<sub>3</sub>P) may be present.

### Production of Organosilicon Compounds

DEUTSCHE GOLD-UND SILBER-SCHNEIDANSTALT  
*British Patent 1,158,510*  
A compound containing at least one Si-H group is reacted with an organic compound containing at least one C=C or C≡C in the presence of a catalyst of general formula PtX<sub>2</sub>(RCOCR'COR'')<sub>2</sub> e.g. dichloroplatinum(IV) acetylacetonate.

### Catalytic Oxidation of Olefines

FARBWERKE HOECHST A.G. *British Patent 1,158,706*  
Olefines are oxidised (O<sub>2</sub> or air) in the liquid phase in the presence of a solution containing an (organic) acid, a Pd salt (e.g. PdCl<sub>2</sub>) and a suspension of an inert powder (active C, SiC, etc.) of specified particle size.

### Palladium Carbonyl Halide

OLIN MATHIESON CHEMICAL CORP.  
*U.S. Patent 3,438,750*  
New carbonylation agents have the formula

$[\text{Pd}(\text{CO})\text{X}_2]_n$  where X is halogen and n is 2-1,000,000 and are made by reacting  $\text{PdX}_2$  and/or  $\text{PdHX}$  with CO.

#### Olefine-palladium Chloride Complex

W. R. GRACE & CO. *U.S. Patent 3,439,009*  
An olefine dimerisation catalyst is a complex of formula  $\text{L}_2\text{Pd}_2\text{Cl}_4$ , where L is a 2-12C mono-olefine such as  $\text{C}_2\text{H}_4$ .

#### Silicon-Olefine Addition Catalyst

IMPERIAL CHEMICAL INDUSTRIES LTD  
*U.S. Patent 3,439,014*  
The catalyst is a complex of  $\text{PdX}_2$  and an organic sulphide, e.g.  $\text{PtCl}_2$  and diethyl sulphide.

#### Catalyst for Chemical Reactions

JOHNSON MATTHEY & CO. LTD  
*German Patent 1,442,733*  
The catalyst is an intimate homogeneous mixture (not a purely physical mixture) of 99-90 wt%  $\text{PtO}_2$  and 1-10 wt%  $\text{RuO}_2$ .

## FUEL CELLS

#### Porous Electrode Material

ALLMANNA SVENSKA ELEKTRISKA A.B.  
*British Patent 1,151,938*  
An electrode material for fuel cells is made by applying a Pt group metal on a porous conducting body. This is accomplished by contacting the pores with a Pt group metal compound (e.g. Pd acetylacetonate, other acetylacetonates (Pt, Rh, Ir, Ru) or Pt carbonyl chlorides) which is decomposable in the gaseous state.

#### Fuel Cell Membranes

LEESONA CORP. *British Patent 1,152,580*  
A high-strength supported Pd-Ag alloy membrane is made by coating a Ni gridlike support with a thin layer of Au, contacting this coated grid with a thin Pd-Ag alloy membrane under pressure and heating (also under pressure) to a temperature sufficient to bond the support to the membrane.

#### Catalysts for Fuel Cell Electrodes

SUN OIL CO. *U.S. Patent 3,428,490*  
The  $\text{H}_2$  electrode of a  $\text{H}_2$ - $\text{O}_2$  cell is prepared from 88-99% of a diluent metal matrix (Ag, Cr, Ti, etc.) and 12-1% of an alloy of a catalytic noble metal and Al (e.g. Al-Pd). On leaching the product the major portion of the Al is removed.

#### High Temperature Fuel Cell

GENERAL ELECTRIC CO. (NEW YORK)  
*U.S. Patent 3,432,352*  
A high temperature (800°C) fuel cell contains a porous film of Pd metal between and in contact with the solid  $\text{O}_2$  ion electrolyte and the porous C anode. The electrolyte is stabilised  $\text{ZrO}_2$  and the Pd film is preferably about  $1\mu$  thick.

#### Electrochemical Power Supply with Moveable Anodes

TEXAS INSTRUMENTS INC. *U.S. Patent 3,432,354*  
A fuel cell using aqueous electrolyte and a cathode comprising a Pt-type catalytic material has an anode in the form of a strip of metal which may be wound through the cell.

#### Electrode for Fuel Cell

U.S. SECRETARY OF THE INTERIOR  
*U.S. Patent 3,433,680*  
The fuel cell electrode for a solid electrolyte cell is made of Pt fused to the electrolyte in a reducing atmosphere.

#### Catalytic Fuel Cell Electrodes

LEESONA CORP. *U.S. Patent 3,438,815*  
The electrodes consist of a porous integral layer of metal covered with a layer comprising a catalytic metal dispersed in a hydrophobic metal, e.g. Pt black in ptfe applied to a porous Ni sheet.

#### Fuel Cell Gas Electrode

SHELL OIL CO. *U.S. Patent 3,438,817*  
An electrode consists of a porous base coated with an electrically conducting film and then coated with (a) a first catalytic coating consisting of Pt metal, Ni, Ag or C in a polymeric binder and (b) a second coating of Pt metal, Ni, Ag or C in a second different polymeric binder.

#### Fuel Cell Electrodes

AMERICAN CYANAMID CO. *U.S. Patent 3,440,107*  
A noble metal compound (containing Pt or Rh or both) is treated with a polysubstituted silane containing Si-H groups in an alcoholic solvent in the presence of an electrically conductive filler. A chemically reduced noble metal of specified crystallite size is thereby precipitated on to the conductive filler.

#### Porous Sinter Electrodes

ROBERT BOSCH G.M.B.H. *German Patent 1,471,756*  
Fuel cells gave a porous sinter electrode of Ni alloy having a skeletal structure. The Ni alloy has up to 20 at.% of Ti, V, Cr, Co, Mo, Ru, Ta, etc. The structure supports a Pt metal alloy.

## CHEMICAL TECHNOLOGY

#### Separation of Hydrogen from Other Gases

INTERNATIONAL NICKEL LTD  
*British Patent 1,152,283*  
 $\text{H}_2$  is separated from gaseous mixtures containing more than 50%  $\text{H}_2$  by causing Pd to absorb H at a relatively high pressure and desorb it at a relatively low pressure. The cycle of adsorption and desorption is repeated under such conditions that 45-80% saturation of Pd with H is achieved at the end of each adsorption step. The Pd is of specified surface area. See also *British Patent 1,153,636*.

## Continuous Monitoring of Hydrogen and Oxygen

THE BOEING CO.

*U.S. Patent 3,426,579*

The fluid containing H and O to be monitored impinges on a heated Pd alloy barrier in a chamber which has been activated with H<sub>2</sub>. The other side of the barrier is pumped down to a low vacuum. The H<sub>2</sub> passes through the barrier and the pressure difference created is a measure of the amount present in the liquid.

## Activated Platinum Coatings for Electrodes

ORONZIO DE NORA IMPIANTI ELETTROCHIMICI S.A.S.

*U.S. Patent 3,428,544*

An electrode (for the electrolysis of salt solutions) comprises a metallic base (Ti) coated with at least one Pt group metal containing 0.2–2.0% of an activating metal selected from Sb, Cd, Pb, Cu, Ta, V or Nb.

## Hydrogen Separation and Purification

UNION CARBIDE CORP.

*U.S. Patent 3,439,474*

H<sub>2</sub> is separated from gas mixtures by means of a H<sub>2</sub> diffusion barrier foil consisting of an alloy of 37.5–42 wt% Cu and the remainder Pd.

## Activation of Platinum Metal Electrodes

JOHNSON MATTHEY & CO. LTD

*Dutch Patent 125,889*

Particularly active electrodes for use in brine electrolysis are produced by exposing a Ti electrode plated with Pt group metal or alloy, in particular Pt, Pt-Rh or Pd-Ag, to the action of Hg vapour or alkali metal amalgam vapour, the Hg coating being distilled off after it has been deposited to leave the surface in a highly active state. This corresponds to *British Patent 957,703*.

## GLASS TECHNOLOGY

### Alloys for Glass Making Equipment

JOHNSON MATTHEY & CO. LTD

*British Patent 1,155,563*

Pt-Rh-Au alloys for use in contact with molten glass contain, apart from impurities, 65–97% Pt, 2–25 Rh and 1–10% Au. The compositions are specified in the form of an area represented on a triangular diagram. The alloy is produced by melting together pure Pt and pure Rh in sponge form and pure Au in grain form, then chill casting into an ingot.

## ELECTRICAL AND ELECTRONIC ENGINEERING

### Thermionic Diodes

PHILIPS ELECTRONIC & ASSOCIATED INDUSTRIES LTD

*British Patent 1,150,930*

The cathode of a thermionic diode is of the dispenser type, with a porous W member coated with a thin layer of Os, Ir, Re or Rh. The anode

(Cu or Mo or Au-plated Mo) is in the form of a disc. In operation the anode temperature is less than 450°K, the cathode temperature is ~1050°K.

## Metallising Compositions

INTERNATIONAL BUSINESS MACHINES CORP.

*British Patent 1,151,298*

A pattern of electrically conductive material may be provided on a ceramic substrate by firing on to the substrate a composition which includes a vitreous frit and a particulate metal. The latter is 59.8–70% Au, 10–20% Pt and the balance Pd.

## Resistors

E. I. DU PONT DE NEMOURS & CO.

*British Patent 1,151,658*

Pd-based resistors are encapsulated with a glaze made from a composition consisting of (A): a major part of a glass frit (from PbO, CdO, B<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, or from PbO, PbF<sub>2</sub>, B<sub>2</sub>O<sub>3</sub> and SiO<sub>2</sub>, of specified composition) and (B): a minor part of finely divided fused SiO<sub>2</sub>, petalite, spodumene, beta-eucryptite (or any mixture of these).

## Metallising Compositions

E. I. DU PONT DE NEMOURS & CO.

*British Patent 1,151,797*

A composition useful for metallising electrodes consists of 75–95% of a finely divided noble metal powder (e.g. Ag, Pt and Pd in specified ratios) and 25–5% of a finely divided inorganic binder (e.g. BiO<sub>3</sub> and a Na Cd borosilicate glass). See also *British Patents 1,152,502* and *1,154,890*.

## Electrical Resistors

T.R.W. INC.

*British Patent 1,158,381*

A vitreous enamel resistor composition consists of a mixture of a glass frit, finely divided particles of an electrically conductive material (Pd and Ag in specified amounts) and kaolin.

## Palladium Ohmic Contact for Semiconductors

INTERNATIONAL BUSINESS MACHINES CORP.

*U.S. Patent 3,431,472*

Pd metal is deposited on to the desired regions of a Si body below the Pd/Si eutectic temperature. It is then sintered to produce a firm bond on the body and then Au leaf is compression-bonded in situ to each contact.

## Ruthenium Sparking Plug Electrodes

JOHNSON MATTHEY & CO. LTD

*Japanese Patent 532,729*

Sparking plug electrodes, without a fibrous structure and resistant to Pb and its compounds at high temperature, are made from Ru powder or a Ru-Ir alloy powder of specified particle size. All particles must be in the range 1–76 $\mu$  and the 10–20 and 20–30 $\mu$  particles must represent, respectively, 20–35% and 30–50% of the powder weight. This corresponds to *British Patent 1,099,387*.