

## CHEMICAL TECHNOLOGY

### Enhanced Low Temperature Sintering of Tungsten

R. M. GERMAN and Z. A. MUNIR, *Metal. Trans.*, 1976, **7A**, (12), 1873-1877

The influence of Pd, Pt, Fe, Co, Ni and Cu additions on the sintering of a fine W powder was studied using the isothermal and constant heating rate experiments at 900-1400°C. The results show that Pd is the best activator for the densification of W, followed by Ni, Co, Pt and Fe. A considerable acceleration of the sintering process is obtained when four atomic monolayers of Pd are present on the W powder surface. Near-theoretical densities are achieved at temperatures as low as 1200°C.

## ELECTRICAL AND ELECTRONIC ENGINEERING

### Differences between Platinum- and Gold-doped Silicon Power Devices

M. D. MILLER, *I.E.E.E. Trans. Electron Devices*, 1976, **ED-23**, (12), 1279-1283

The effects of Au and Pt diffusions on the properties of Pt- and Au-doped p<sup>+</sup>-n<sup>-</sup> junctions were studied. It was found that there are substantial differences between the energy levels introduced by these impurities. Pt shows improved high-temperature properties and turn-on performance and is better for devices which are switched on rapidly.

## NEW PATENTS

### METALS AND ALLOYS

#### Solution Hardened Alloys Containing Palladium

U.S. ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION *U.S. Patent* 3,976,479

Solution hardened alloys of Cu, for example, containing equal atomic percentages of Pd and Al are formed by using at least two solutes which form associated solute pairs in the solvent metal lattice.

#### Ruthenium Powder Alloy

GENERAL MOTORS CORP. *U.S. Patent* 3,977,841

Ductile Ru alloys are prepared by mixing 70-80% Ru powder with 20-30% prealloyed powder (containing Co, Ni, Cr, W and Si), both powders being of less than 200 mesh size, pressing at 35,000-50,000 psi, and sintering in dry and/or in a vacuum, at 2150-2250°F for 30-45 min.

### Materials Selection in Hybrid Product Design

R. D. GOLD, *Solid State Technol.*, 1977, **20**, (1), 31-35 and 57

The Pd-Ag conductor paste was found to be economical and reliable as a solderable conductor when used with a Sn-free Pb-Ag-In solder, in the manufacture of power hybrid voltage regulators.

## MEDICAL USES

### Anti-tumour Agents Synthesised from K<sub>2</sub>PtCl<sub>4</sub> and Polymeric or Cyclic Phosphazenes

H. R. ALLCOCK, R. W. ALLEN and J. P. O'BRIEN, *J. Chem. Soc., Chem. Commun.*, 1976, (18), 717-718

Complexes between a square-planar Pt unit, K<sub>2</sub>PtCl<sub>4</sub>, and polymers such as the phosphazenes [NP(NHMe)<sub>2</sub>]<sub>n</sub>, [NP(NHMe)<sub>2</sub>]<sub>4</sub> or [NPMes]<sub>4</sub> were obtained. These complexes of the type [H<sub>2</sub>N<sub>4</sub>P<sub>4</sub>R<sub>8</sub>]<sup>2+</sup>[PtCl<sub>4</sub>]<sup>2-</sup> show significant anti-tumour behaviour in preliminary testing.

### An Explanation for the Efficacy of Attack by Platinum Blue Drugs on Biopolymers

C. G. F. BLAKE, S. J. OATLEY and R. J. P. WILLIAMS, *J. Chem. Soc., Chem. Commun.*, 1976, (24), 1043-1044

Platinum halides and amides can react to form platinum blues, useful anti-tumour agents which are used as stains for biological specimens. Studies made of the interaction of these polymeric compounds with protein crystals have suggested a possible mode of action.

### Ruthenium Alloy for Use in Composite Seals

W. H. FENGLER *U.S. Patent* 3,991,229

A base metal, such as the Al or Fe housing of a rotary or reciprocating-piston I.C.E. and a sealing member for its pistons or rotor are coated with a layer of a wear resistant alloy such as Ru-W.

## ELECTRODEPOSITION AND SURFACE COATINGS

### Platinum-Rhodium Containing High Temperature Alloy Coating

CHROMALLOY AMERICAN CORP.

*British Patent* 1,463,447

The heat resistance of Ni- and/or Co-based alloys is improved by cleaning the surface of the alloy, thermally diffusing first and second coatings of Rh and Pt respectively on to the alloy surface and pack-aluminising the alloy.

## Electroless Metal Plating

IMPERIAL CHEMICAL INDUSTRIES LTD.

*British Patent 1,463,803*

A substrate is exposed to sensitising radiation when coated with a  $H_2O$  soluble quaternised bipyridilium compound dissolved or dispersed in a  $H_2O$  permeable film forming matrix, activated by contact with a solution of  $PdCl_2$  and  $HCl$ , contacted with an aqueous solution of a reducing agent other than formaldehyde solution and contacted with an aqueous electroless metal such as Co plating bath.

## Electrical Heating Unit with a Protective Overglaze

CORNING GLASS WORKS *U.S. Patent 3,974,360*

An integral element type heating unit consists of a Pt film bonded to a supporting ceramic plate. The platinum film element is electrically stabilised and physically protected by a  $PbTiO_3$  overglaze.

## Titanium/Silver/Palladium Metallisation System

MOTOROLA INC. *U.S. Patent 3,978,517*

A glass encapsulated double-plug diode has a semiconductor substrate on which are disposed successive layers of Ti, Ag and Pd.

## Coating Noble Metals on Bonding Tools

TRIBOTECH *U.S. Patent 3,986,653*

Os, Ru and/or their alloys are electrodeposited from their alkali metal salts in a non-aqueous solvent, such as methanol or DMF on to the tips of bonding tools. The tips may also optionally be coated with a chemically bonded Si layer on top of the metal layer.

## Ruthenium Coated Oxide Supports

EXXON RESEARCH AND ENGINEERING CO.

*U.S. Patent 3,990,998*

The high surface area, multilayered oxide supports with a Ru coating have the composition  $Ru-MgO-MgAl_2O_4-MgAl_2O_4 + Mg_2SiO_4$ -Core. The products are used in the treatment of waste gases especially I.C.E. exhaust gases.

## Thallium Palladate Anode Coating

C. CONRADTY *U.S. Patent 3,991,158*

$TlPd_2O_4$  for use as a coating layer for metal anodes is prepared by heating  $TlNO_3$  to  $350^\circ C$  to give  $Tl_2O_3$  and  $NO$  and  $NO_2$ , heating the  $Tl_2O_3$  to  $500^\circ C$  to give  $Tl_2O$  and  $O_2$  and adding  $PdO$  to the  $Tl_2O$  to give  $TlPd_2O_4$ .

## Noble Metal Coated Lamp Current Conductors

U.S. PHILLIPS CORP. *U.S. Patent 3,991,337*

The outer Mo current conductors of electric lamps with quartz glass lamp envelopes and pinched seals have a corrosion metal coating of Pt, Pd, Au or Ir on a primer layer of Ni or Cu.

## LABORATORY APPARATUS AND TECHNIQUE

### Oxygen Sensor

NISSAN MOTOR CO.

*British Patent 1,462,336*

A sensor for use in an I.C.E. exhaust system has a cylindrical solid  $O_2$ -ion electrolyte which is a ceramic composed of  $ZrO_2$  and  $CaO$  whose inner and outer surfaces are coated with Pt.

### Oxygen Sensors

ROBERT BOSCH G.M.B.H. *British Patent 1,462,639*

An electrochemical sensor for determining the  $O_2$  content of I.C.E. exhaust has an  $O_2$  concentration cell with an ion conducting solid electrolyte in the form of a tube which is closed at one end and on the outer surface of which is located an electron conducting layer for catalysing the attainment of gas equilibrium. The electron conducting layer is formed of Pt, Pd or Ir (alloy) and may have additional refractory metal such as Ag or Au layers.

## JOINING

### Heat Resistant Sealing Materials

NATIONAL RESEARCH DEVELOPMENT CORP.

*British Patent 1,455,428*

A new heat resistant material for sealing bodies together in TV screens consists of 5-40% Ca oxide, 35-70%  $SiO_2$ , 9-30%  $MgO_2$  and 3-30%  $Al_2O_3$ . Several examples illustrate the bonding of a Pt disc, Pt or Pt-Rh wires or Pt alloy discs to  $Al_2O_3$  or  $ZrO_2$  in thermocouple production.

### Metallisation Process for Bonding a Semiconductor Die to Terminals

MOTOROLA INC.

*U.S. Patent 3,987,217*

A metallisation system for metallurgically bonding a semiconductor die to metallic conducting slugs and terminals uses a combination of Pd, Al and Sn, for bonding to Mo.

## HETEROGENEOUS CATALYSIS

### Dehydroxylation of Aminoglycosides

TAKEDA CHEMICAL INDUSTRIES LTD.

*British Patent 1,460,039*

New deoxyaminoglycoside antibiotics may be prepared by reduction of intermediate halogenated compounds using Pt group metal catalysts.

### Stabilised Ruthenium Catalysts

JOHNSON MATTHEY & CO. LTD.

*British Patent 1,460,273*

A catalyst is formed by a mixed oxide having one of the empirical formulae:  $RuO_2 \cdot xTiO_2$ ;  $RuO_2 \cdot xZrO_2$ ;  $RuO_2 \cdot xHfO_2$ ;  $RuO_2 \cdot xNb_2O_5$  and  $RuO_2 \cdot xBi_2O_3$  where  $x > 1$ . The catalyst is used in the purification of I.C.E. exhaust gases.

### High Severity Reforming Process with a Platinum-Iridium Catalyst

EXXON RESEARCH AND ENGINEERING CO.

*British Patents 1,461,946-7*

A naphtha feedstock having a Watson characterisation factor of 11.4-12.2 and H<sub>2</sub> are contacted with a catalyst comprising 0.15-0.75% Pt, 0.15-0.45% Ir and 0.3-2% halogen. The catalyst is supported on Al<sub>2</sub>O<sub>3</sub>.

### Purifying Hydroquinone

GOODYEAR TYRE AND RUBBER CO.

*British Patent 1,464,072*

Photographic grade hydroquinone is prepared by treating a solution of technical grade hydroquinone in the presence of a Pd catalyst with H<sub>2</sub> while the solution is at a pH of 3-6.

### Platinum Containing Molecular Sieve Catalyst

JOHNSON MATTHEY & CO. LTD. *U.S. Patent 3,979,329*

A selective molecular sieve catalyst is prepared by treating furfuryl alcohol with an aqueous solution of chloroplatinic acid and warming the mixture to initiate polymerisation of the alcohol, drying the polymer by heating under N<sub>2</sub> and curing by heating to 200°C for 16 h and carbonising the polymer by heating to 650°C for 4 h. Similar catalysts can be prepared, using Ru, Rh, Pd, Os, Ir, Fe, Co, Ni and Cu, and all catalysts are very selective for hydrogenation reactions.

### Multimetallic Conversion Catalyst Containing a Noble Metal

UNIVERSAL OIL PRODUCTS CO.

*U.S. Patent 3,986,948*

A catalyst for hydrocarbon conversion reactions is a porous carrier material on which is deposited 0.01-2.0% Pt or Pd, 0.01-2.0% Rh, 0.01-5.0% Sn, 0.1-3.5% halogen and 0.01-1.0% S. The Pt or Pd, Rh and Sn are uniformly dispersed throughout the carrier and the noble metals are in the form of their sulphides.

### Platinum Group Dehydrogenation Catalyst for Catechol Production

SUN VENTURES INC.

*U.S. Patent 3,987,112*

In a 4-stage process for the production of catechol from a mixture of cyclohexanol/cyclohexanone the fourth step is a dehydrogenation process carried out in the presence of a catalyst which is Pd, Pt, Ru, Os, Ir or Rh.

### Platinum Group Catalyst for Self-Cleaning Oven Coatings

IMPERIAL CHEMICAL INDUSTRIES LTD.

*U.S. Patent 3,988,514*

A self-cleaning catalytic coating for cooking oven walls consists of a sintered matrix of hard catalyst particles, of Pt group, Cu, V, Bi, Mo, Mn, Fe, Ni, or others, their mixtures, or their oxides, and binder particles.

### Platinum Group Metal Catalyst for Decomposition of Carbohydrate Wastes

U.S. ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

*U.S. Patent 3,989,480*

Carbohydrate waste materials are decomposed to form a gaseous fuel product by contacting with a metal chosen from Rh, Ir, Pd, Pt, Ni, Co or Cu-Ni or Ni-Fe-Cr alloys and heating in the absence of H<sub>2</sub>O.

### Crosslinked Platinum Catalyst-Inhibitor

DOW CORNING CORP.

*U.S. Patent 3,989,666*

The composition is prepared by heating in a closed system for 10-30 h, at 50-90°C a mixture of a siloxane, an acetylenic alcohol and a Pt catalyst, followed by removal of unreacted alcohol. When combined with a vinyl containing siloxane polymer it retards the actions of Si-bonded H atoms with aliphatic unsaturation catalysed by Pt.

### Rhodium Catalyst for Propionic Acid Production

MONSANTO CO.

*U.S. Patent 3,989,747*

A one step process for propionic acid production involves the reaction of C<sub>2</sub>H<sub>4</sub> with CO and H<sub>2</sub>O at mild pressure in the presence of a Rh catalyst and a bromide promoter.

### Multiple Group VIII Metal Containing Catalyst

STE. FRANCAISE DES PRODUITS POUR CATALYSE

*French Appl. 2,287,496*

The catalyst, for hydrocarbon conversion processes, has a support, 0.005-2.0% Pt, 0.005-1.0% of a metal chosen from Ir, Rh and Ru, 0.05-0.8% Co, 0.005-1.0% of at least one metal chosen from Cu, Mn, Ag and Au and 0.1-10.0% halide.

## HOMOGENEOUS CATALYSIS

### Producing Triols and Diols

CHEVRON RESEARCH CO.

*British Patent 1,463,994*

Triethanolmethane and 3-methyl-1,5-pentandiol are produced by contacting a mixture of 3-methylene-1,5-pentandiol and 3-methyl-2-pentene-1,5-diol with a homogeneous Rh catalyst in the presence of CO at 25-5000 psig and H<sub>2</sub> at 50-1000 psig, at 75-250°C.

## CHEMICAL TECHNOLOGY

### Restoring the Activity of a Reforming Catalyst

BRITISH GAS CORP.

*British Patent 1,463,661*

A mixture of steam and the vapour of an aliphatic alcohol is passed over a deactivated steam reforming catalyst, such as a Ru-Zn/Al<sub>2</sub>O<sub>3</sub> catalyst. The mixture is preheated prior to contact with the catalyst to at least 350°C such that the catalyst bed temperature is maintained by the reactions at 400-600°C.

## Hollow Spheres for Encapsulating Precious Metals

CANADIAN PATENTS & DEVELOPMENT LTD.

*U.S. Patent 3,975,194*

Microballoons which can incorporate small particles of Pt, Ag or Au, for jewellery purposes, or can be used to form hollow Pt/Al<sub>2</sub>O<sub>3</sub> catalyst beads, are prepared by uniformly dispersing a soluble film-forming solid into a core solvent, shaping this mixture while still in the molten state, cooling to solidify as a shaped blend, slowly transforming the solid cone into a gas and removing and recovering the microballoons which have an inner sponge lining. The metal particles can be dispersed in the core while it is liquid and will migrate to form part of the shell.

## Noble Metal Halides as Colour Stabilisers

MONSANTO CO.

*U.S. Patent 3,975,408*

The colour stability of refined dicarboxylic acid anhydrides, such as maleic anhydride, is improved by the addition of 0.01–1,000 ppm of a halide of Ru, Rh, Pd, Os, Ir or Pt.

## Platinum, Silver and Palladium Reaction Rate Modifiers for Hydrogen Production

U.S. SECRETARY OF THE NAVY

*U.S. Patent 3,977,990*

H<sub>2</sub> gas evolution rates and the gas temperature of hydrogen generating solid compositions are modified by the addition of small amounts of various compounds including PtO<sub>2</sub>, Pd, Ag<sub>2</sub>CO<sub>3</sub>, PdCl<sub>2</sub>.

## Refining Platinum Group Metals

MATTHEY RUSTENBURG REFINERS (PTY) LTD.

*U.S. Patent 3,979,207*

The separation and purification of platinum group metals, especially mixtures of Rh, Pt and Ir, which are present as salts in aqueous solution is achieved by adjusting the pH, as necessary, to provide an acidic solution, contacting this with an oxidising agent sufficient to oxidise all Ir present to Ir(IV), then contacting the solution with a N<sub>2</sub>-containing organic compound (chosen from secondary and tertiary amines and quaternary ammonium compounds), removing an organic phase which contains all the Pt and Ir present, removing the Ir from this phase by contacting with an aqueous solution of a reducing agent and removing the Pt remaining in the organic phase with an aqueous stripping solution.

## Recovery of Noble Metals from Car Exhaust Catalysts

JOHNSON MATTHEY & CO. LTD.

*U.S. Patent 3,985,854*

Pt, Rh and other precious metals are recovered from exhaust gas catalysts, which are preferably crushed, powdered or broken, by reacting them with an acid medium having oxidising properties to leach out the metals. The leaching step can be preceded by a reduction step.

## ELECTRICAL AND ELECTRONIC ENGINEERING

### Light Emitting Display Device

TOKYO SHIBAURA ELECTRIC CO. LTD.

*British Patent 1,455,195*

The device has an electric insulation base plate bearing printed conductive layers and conductive light reflectors of which one is made of one metal from the group Pt, Ag, Au, Ni and Al and the other is made from one metal of the above group but having a different colour.

### Resistance Composition

C.T.S. CORP.

*British Patent 1,462,526*

An electrical resistance composition comprises a mixture of glass particles, a conductive phase consisting of RuO<sub>2</sub> and Ir, the Ir being present as an organometallic compound in solution, and a liquid carrier.

### Silver-Palladium Film with Improved Adhesion

JOHNSON MATTHEY & CO. LTD.

*German Offen. 2,616,060*

A composite film, such as a Ag-Pd and Bi oxide thick film for a circuit, is obtained by using the molten oxide constituent to hold particles of the metal in place as a conducting layer.

## MEDICAL USES

### Determining the Perfusion Efficiency Factor of Animal Tissue

L. ESCHWEILER & CO.

*British Patent 1,461,345*

The rate of perfusion of an indicator substance is percutaneously measured in the tissue at a specified locus, and the indicator concentration is simultaneously measured at the same locus. Signals are obtained in dependence on the measurements and the signals are combined to obtain a composite signal corresponding to the factor. The apparatus used includes Ag/AgCl sensors and Pt electrodes.

### Palladium Dental Alloys

FA. DR. TH. WIELAND

*German Offen. 2,523,971*

Pd alloys which are readily joined to porcelain for dental purposes contain 20–45% Ag, 0.1–10% of at least one hardening additive such as Fe, Co or Ni, 50–80% Pd and 0.1–0.5% Ti. The presence of Pd increases the adherence to porcelain and colour reproduction.

### Reduced Gold Dental Alloy

JOHNSON MATTHEY & CO. LTD.

*Dutch Appl. 76.02206*

An alloy for use in restorative dental treatment contains 45–62% Pd, 25–42% Au, 5–22% Ag, up to 5% Ga, up to 2% In and up to 1% Sn.