

## Reactions of ( $\eta$ -Allyl)tricarbonylchlororuthenium(II) with Hydrogen and Unsaturated Substrates: Catalytic Hydrogenation and Isomerisation of Alkenes

G. SBRANA, G. BRACA and E. BENEDETTI, *J. Chem. Soc., Dalton Trans.*, 1975, (9), 754-761

Studies were made of the reactions of  $[\text{RuCl}(\text{C}_3\text{H}_5)_2(\text{CO})_3]$ , with unsaturated substrates such as acrylonitrile (acn), alkynes, butadiene, and acetylenic esters using i.r. and n.m.r. techniques. The solids  $[\{\text{RuCl}(\sigma\text{-C}_3\text{H}_5)(\text{CO})_2(\text{acn})\}_2]$ ,  $[\{\text{RuCl}(\text{OC.CR}:\text{C}_3\text{H}_5)(\text{CO})_2\}_2]$  ( $\text{R}=\text{R}'=\text{H}$ ;  $\text{R}=\text{H}$ ,  $\text{R}'=\text{Ph}$ ; and  $\text{R}=\text{R}'=\text{Rh}$ ), and  $[\text{RuCl}\{(\text{C}_4\text{H}_9)_2\text{C}_3\text{H}_5\}(\text{CO})_3]$  were isolated. In the case of diethyl acetylenedicarboxylate an alkenyl complex of formula  $[\text{RuCl}\{\text{C}(\text{CO}_2\text{Et})\text{CH}.\text{C}(\text{OEt})\text{O}\}(\text{CO})_3]$  was obtained.

## Asymmetric Synthesis by Chiral Ruthenium Complexes. I: Enantioselective Hydrogenation of Ketones and Ketoximes Catalysed by $\text{H}_4\text{Ru}_4(\text{CO})_8$ [(-)-DIOP] $_2$

C. BOTTEGHI, M. BIANCHI, E. BENEDETTI and U. MATTEOLI, *Chimia*, 1975, 29, (6), 256-258

$\text{H}_4\text{Ru}_4(\text{CO})_8$  [(-)-DIOP] $_2$  catalyses asymmetric hydrogenation of C-O and C-N double bonds at high temperature and pressure. In the case of *z*-butylphenylketoxim the degree of asymmetric induction reaches 14.5%.

## Acid-dependent Selectivity in the Homogeneous Hydrogenation of Mono- and Dienes by Acetatotriphenylphosphine Complexes of Ruthenium and Rhodium

A. SPENCER, *J. Organometal. Chem.*, 1975, 93, (3), 389-395

The hydrogenation of mono- and di-enes by catalysts derived from protonation of  $\text{Ru}(\text{CO}_2\text{Me})_2(\text{PPh}_3)_2$  and  $\text{Rh}(\text{CO}_2\text{Me})(\text{PPh}_3)_3$  in methanolic solution with *p*-toluenesulphonic acid was studied. The rate of hydrogenation is highly dependent on the acidity. Rapid highly selective reduction of cyclic dienes to monoenes occurs. This selectivity is attributed principally to the superior coordinating power of the dienes.

# NEW PATENTS

## CHEMICAL COMPOUNDS

### New Rhodium Carbonyl Salts

UNION CARBIDE CORP. *U.S. Patent* 3,878,290  
New salts have the formula  $\text{M Rh}_{12}(\text{CO})_{30}$  where M is divalent Be, Mg, Ca, Sr, Ra, Sc, Y, Mn, Fe, Ru, Re, Co, Ni, Pd, Pt, Zn, Cd, Hg, Ce and Eu.

## CHEMICAL TECHNOLOGY

### Interaction of Os (IV) Halogen Complexes with Trialkylphosphine Oxides in Extraction Processes

K. A. BOLSHAKOV, N. M. SINITSYN, N. M. BODNAR and M. N. SHAKHOVA, *Zh. Neorg. Khim.*, 1975, 20, (6), 1641-1646

Extraction of Os in the form of  $[\text{OsCl}_6]^{2-}$  and  $[\text{OsBr}_6]^{2-}$  complexes in HCl medium was carried out using tri-*n*-butylphosphine oxide and tri-*n*-octylphosphine oxide. The extent of Os recovery measured in terms of coefficient of distribution D increases with increasing HCl concentration and attains a maximum at  $\sim 4$  mol HCl. The influence of different extracting reagents, ligands and diluents on the recovery process as well as on the structure and properties of the complexes obtained was also investigated.

## ELECTRICAL AND ELECTRONIC ENGINEERING

### I-V Characteristics of PtSi-Si Contacts Made from CVD Platinum

M. J. RAND, *J. Electrochem. Soc.*, 1975, 122, (6), 811-815

The use of CVD Pt to make PtSi contacts was studied. With heavily doped Si and sintering at 450-700°C no electrical anomalies appear. With light doping there is still no problem provided a relatively low ( $\sim 450^\circ\text{C}$ ) is used. CVD Pt reliably forms PtSi at this temperature. The effects of higher contact formation temperatures are discussed.

## TEMPERATURE MEASUREMENT

### Rh-Ir Thermocouples Operate at 2100°C

L. R. THOMAS, *Metal Prog.*, 1975, 107, (6), 55

The new Feussner thermocouples, Ir:40% Ir-Rh, are recommended for applications where continuous temperatures exceed 1700°C up to 2100°C. Accuracy is  $\pm 10^\circ\text{C}$ . Below 1500°C, Pt is preferred.

## ELECTROCHEMISTRY

### Electrolytic Electrodes

ELECTRONOR CORP. *British Patent* 1,398,211  
Electrolytic electrodes are provided with more stable coatings by depositing a mixture of a Pt-Ir alloy and 2.5-20% of a valve metal oxide on their

surfaces. The preferred coatings consist of a 70% Pt-Ir alloy and TiO<sub>2</sub>.

### Electrowinning of Metals

DIAMOND SHAMROCK CORP.

*British Patent 1,398,378*

An electrode for the recovery of metals by electrolysis has a surface coating containing 1.0–10% Sb<sub>2</sub>O<sub>3</sub>, 30–90% SnO, 1–50% of one or more Pt group metal oxides and 0.5–30% of Ti or Ta oxide.

### Diaphragm Cells for Electrolysis

ORONZIO DE NORA IMPIANTI ELETTROCHIMICI S.p.A.

*British Patent 1,400,053*

Diaphragm cells stacked horizontally for electrolysis have a number of horizontal planar anodes made from a valve metal coated with a catalytic layer containing a Pt group metal or its oxide.

### Electrode Having a Silicide Surface

P.P.G. INDUSTRIES INC. *U.S. Patent 3,862,023*

An electrode with a valve metal substrate has a coating consisting of a Pt group metal silicide chosen from Pd<sub>3</sub>Si, Pt<sub>3</sub>Si and Ru<sub>3</sub>Si<sub>2</sub>.

## ELECTRODEPOSITION AND SURFACE COATINGS

### Ruthenium/Osmium in Cutting Tools

INTERNATIONAL NICKEL LTD.

*British Patent 1,393,115*

A new cutting tool, e.g. a carbide tool, has a coating of Ru and/or Os on the surfaces adjacent to the cutting edge. In one example the tips of a tool containing 83% W carbide, 12% Ti carbide and 5% Co is given a flash coating of Au and then is electroplated with Ru.

### Platinum and/or Iridium Electroplating

RHONE-PROGL

*British Patent 1,399,500*

The mechanical and chemical resistance of Pt and/or Ir deposits are improved by using a bath containing bromoplatinic and/or bromoiridic anions and HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, HClO<sub>4</sub> and/or HBrO<sub>3</sub>. A typical plating bath contains 0.75 g/l ammonium bromoplatinate in 0.35N HClO<sub>4</sub>.

### Siloxane Coating Composition

IMPERIAL CHEMICAL INDUSTRIES LTD.

*British Patent 1,399,885*

Organopolysiloxane coatings are cured by the presence of 0.1% of a Pt group metal halide catalyst complexed with a suitable ligand, e.g. cyclooctadiene or tripropyl phosphine complexes of PtCl<sub>2</sub>.

### Activator Solution for Chemical Plating

ENTHONE INC.

*U.S. Patent 3,871,889*

The solution for activating non-metallic surfaces

contains a Au chloride, Pd chloride or other noble metal—Sn salt complex modified with a lower alkanol.

### Metallised Macromolecular Material

HOECHST A.G.

*U.S. Patent 3,871,903*

A shaped body consists of a solid support thermally resistant at 250–400°C, a sintered film on the surface of the support of polytetrafluoroethylene having a noble metal salt dispersed in it and a metal coating on the surface of the polytetrafluoroethylene film. The noble metal salt is preferably Pd chloride, Pt chloride or Ag nitrate and the metal of the coating may be Ni or Cu.

## LABORATORY APPARATUS AND TECHNIQUE

### Gas Concentration Cells

BAILEY METER CO.

*British Patent 1,400,579*

A solid electrolyte concentration cell has two electrodes and is used for O<sub>2</sub> detection on a porous Pt electrode. The amount of O<sub>2</sub> is indicated by the electrode temperature which is measured by a Au-Pt thick film thermocouple.

### Potentiometric CO Detector

EXXON RESEARCH & ENGINEERING CO.

*U.S. Patent 3,880,722*

In an instrument for the detection and measurement of the CO content of gases, particularly in ICE exhaust gases, CO is reacted with H<sub>2</sub>O to form CO<sub>2</sub> and H<sup>+</sup> and to produce a voltage change which is proportional to the CO content of the gas under suitable conditions. The reaction takes place in an aqueous solution and employs suitable oxidising agents and a Pd salt catalyst.

## JOINING

### Binder for Carbide Tools

INTERNATIONAL NICKEL LTD.

*British Patent 1,393,116*

The carbide particles constituting the tool are held together by a binder containing Co and a lesser or equal amount of Ru and/or Os, e.g. 70% Co–30% Ru.

## HETEROGENEOUS CATALYSIS

### ICE Exhaust Gas Treatment

KALI-CHEMIE A.G.

*British Patent 1,392,528*

In a two bed reduction-oxidation catalyst system, the first bed is used in oxidising conditions during cold starts to generate heat before reverting to the reduction-oxidation operation. The first bed contains a calcined support carrying (a) 0.02–0.1% Rh with 0.05–0.2% Pd or (b) 0.005–0.5% Rh with 0.005–0.5% Ir.

## Hydrogenation Processes

DIAMOND SHAMROCK CORP.

*British Patent 1,393,659*

An unsaturated carbocyclic or heterocyclic compound, such as benzene, pyridine but especially a 2,5-dialkyl-pyrrole, is converted to a corresponding saturated compound in the presence of a mixture of a H<sub>2</sub>O soluble unreduced Ru salt and Al<sub>2</sub>O<sub>3</sub>. In the examples, Al<sub>2</sub>O<sub>3</sub> and Ru chloride are milled together.

## Hydrogen Isotope Exchange Catalyst

ATOMIC ENERGY OF CANADA LTD.

*British Patent 1,394,089*

A longer life Pt group metal catalyst for exchange reactions is obtained by hydrophobing the support, e.g. with a polyolefin or polyacrylate. Thus a Pt/Al<sub>2</sub>O<sub>3</sub> catalyst may be replaced by a Pt/polystyrene catalyst.

## Platinum Group Metal Catalysts

BRITISH PETROLEUM CO. LTD.

*British Patent 1,397,293*

Small amounts of an alkali or alkaline earth metal, when added to a C-supported Pt catalyst, give a marked increase in its dehydrocyclisation activity. The additive such as sodium is present in an amount of 5-100 at.% based on the 0.01-5% Pt on the support.

## Platinum-Coated Catalysts

JOHNSON, MATTHEY & CO. LTD.

*British Patent 1,399,453*

A heterogeneous catalyst for use at high temperatures in reducing or non-oxidising conditions has a refractory carbide, nitride, sulphide or silicide support which is coated with magnesia, preferably in a thickness of 0.0004-0.5 inches depending on its intended use, before the Pt group metal or alloy is deposited on it. The magnesia layer acts as a heat barrier, e.g. in ICE exhaust gas catalytic converters.

## Hydrocarbon Conversion Catalysts

STE FRANCAISE DES PRODUITS POUR CATALYSE

*British Patent 1,400,345*

A catalyst for use in hydrocarbon conversion, e.g. naphtha reforming, of long life and improved mechanical properties consists of an Al<sub>2</sub>O<sub>3</sub> support carrying Pt, Ir and Nb. Preferably the catalyst contains 0.005-1% Pt, 0.005-1% Ir and 0.005-5% Nb.

## Hydrocarbon Reforming Catalyst

AIR PRODUCTS & CHEMICALS INC.

*British Patent 1,400,491*

A reforming catalyst of improved life consists of an Al<sub>2</sub>O<sub>3</sub> support having a surface area of at least 200 m<sup>2</sup>/g a content of 25-50%  $\chi$  type Al<sub>2</sub>O<sub>3</sub>, less than 5%  $\eta$  type and the balance  $\gamma$  type and a bulk density of less than 0.55 kg/l which carries 0.05-0.5% Group VB metal oxide and 0.2-1.5%

Pt group metal. Thus Pt may be used with niobium oxide or vanadium oxide.

## Hydrocarbon Conversion with a Multimetal Catalyst

UNIVERSAL OIL PRODUCTS CO.

*U.S. Patent 3,859,201*

In a process for converting a hydrocarbon charge stock, the stock is contacted with a catalytic composite consisting of a porous carrier material containing 0.01-2% Pt group metal, 0.01-2% Re, 0.1-3.5% halogen and Bi in an amount sufficient to result in an atomic ratio of Bi to Pt group metal of about 0.1:1 to about 1:1.

## Ruthenium-Promoted Fluorided Alumina

PHILLIPS PETROLEUM CO. *U.S. Patent 3,864,425*

A method of isomerising paraffin hydrocarbons containing 4-8 C uses a catalytic composition consisting of a Ru-promoted fluorided Al<sub>2</sub>O<sub>3</sub> catalyst containing SbF<sub>5</sub>-HF.

## Reforming with Promoted Platinum-Iridium Catalysts

EXXON RESEARCH & ENGINEERING CO.

*U.S. Patent 3,867,280*

A process for improving the octane quality of naphtha consists of contacting the naphtha in an on-oil portion of an operating cycle at reforming conditions with a catalyst composite including a porous inorganic oxide support, 0.1-2% halogen, 0.05-3% Pt, 0.05-3% Ir and 0.5-5% Fe or Bi based on the total weight of the catalyst, and in a subsequent portion of an operating cycle, burning of deposited coke with an O<sub>2</sub>-containing gas.

## Nuclear Hydrogenation of N-Aryl Polyamides

UNIROYAL INC.

*U.S. Patent 3,867,443*

A method for nuclear hydrogenation of an N-aryl polyamide to an N-alcyclic polyamide consists of contacting the N-aryl polyamide with H<sub>2</sub> in the presence of an acid-treated Rh hydrogenation catalyst at 5-250°C.

## Catalyst Production of Nitric Acid

DEUTSCHE GOLD- & SILBER-SCHNEIDANSTALT

*U.S. Patent 3,873,675*

In a process of forming NO<sub>x</sub> by the gas phase oxidation of NH<sub>3</sub> with air in the presence of a Pt-containing catalyst, an improved catalyst consists of 55-70% Pd, 1-6% Rh and/or Ru and the balance Pt.

## Platinum-Tin Catalyst Regeneration

CHEVRON RESEARCH CO.

*U.S. Patent 3,875,049*

Hydrocarbons are hydroconverted over a catalyst consisting of 0.01-5% Pt group metal, 0.01-5% Sn and 0.1-3% of a halogen on a porous solid support, such as SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub>, and the spent catalyst is regenerated by heating it with a gas containing oxygen and a halogen.

### Three Metal Hydroconversion Catalyst

UNIVERSAL OIL PRODUCTS CO.

*U.S. Patent 3,878,089*

A new hydroconversion catalyst has a spinel,  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$  or other known support carrying 0.01–2% Pt or Pd, 0.01–2% Ir, Bi in an amount giving an atomic ratio of Bi to Pt or Pd of 0.1–1:1 and 0.1–3.5% halogen.

### Support for a Three Metal Conversion Catalyst

UNIVERSAL OIL PRODUCTS CO.

*U.S. Patent 3,878,125*

A mixture of  $\text{Al}_2\text{O}_3$  and a zeolite is used to support a catalytic mixture of Pt or Pd, Ir and a Group IVA metal such as Pb or Ge. Typically 0.1–20% zeolite is used with  $\text{Al}_2\text{O}_3$  to support 0.01–2% of Pt or Pd, 0.01–2% Ir and 0.01–5% Group IVA metal.

### Four Component Dehydrogenation Catalyst

UNIVERSAL OIL PRODUCTS CO.

*U.S. Patent 3,878,131*

A dehydrogenation catalyst consists of  $\text{Al}_2\text{O}_3$  or another support carrying 0.01–2% Pt group metal (Pt or Pd), 0.01–5% Sn, 0.01–5% Ge and 0.01–5% of an alkali or alkaline earth metal. In one example isobutylene is obtained from isobutane using a catalyst containing 0.75% Pt, 0.2% Ge, 0.2% Sn, 0.6% Li and less than 0.15% chloride.

### Platinum-Indium-Molybdenum Reforming Catalysts

EKKON RESEARCH & ENGINEERING CO.

*U.S. Patent 3,880,748*

The octane quality of naphthas is improved by reforming them over a mixture of 0.05–2% Pt, 0.01–2% Mo and 0.05–2% In on  $\text{Al}_2\text{O}_3$  or another inorganic oxide support.

### Platinum Catalyst for Hydrocarbon Conversion

STE FRANCAISE DES PRODUITS POUR CATALYSE

*French Appl. 2,234,922*

A new catalyst, for hydrocarbon conversion reactions, has a support, preferably  $\text{Al}_2\text{O}_3$ , carrying 0.005–1.0% Pt, 0.005–1.0% Ru and 0.005–5% Mn or Re.

### Platinum-Containing Catalyst

STE FRANCAISE DES PRODUITS POUR CATALYSE

*French Appl. 2,234,923*

A new catalyst, for hydrocarbon reforming and other conversion reactions, has a support, preferably  $\text{Al}_2\text{O}_3$ , carrying 0.005–1.0% Pt, 0.005–1.0% Ru and 0.005–5.0% of Ge, Sn, Pb, Ti, Zr or Hf.

### Iridium-Osmium Catalyst

KALI-CHEMIE A.G.

*German Offen. 2,341,363*

A hydrazine decomposition catalyst is obtained

by repeatedly impregnating an  $\text{Al}_2\text{O}_3$  support with a solution containing Ir and Os salts and then reducing the salts.

### Coated Support for a Catalyst

JOHNSON, MATTHEY & CO. LTD.

*German Offen. 2,450,664*

A catalyst, e.g. for  $\text{NO}_x$  removal in spent gases from a  $\text{HNO}_3$  plant, consists of (a) an elongated metal support made from a refractory steel alloy of 3–40% Cr, 1–10% Al, at least 5% Co and/or at least 72% Ni with at least 0.5% C, remainder Fe coated with (b) an oxide layer and (c) a Pt group metal, Ag, Au or their alloys in a catalytic layer. Thus Kanthal D foil may be coated with  $\text{Al}_2\text{O}_3$  and then with Pt.

## HOMOGENEOUS CATALYSIS

### Production of 2-Methyl-1,4-Butanediol

E. I. DU PONT DE NEMOURS & CO.

*U.S. Patent 3,859,369*

A process for the production of 2-methyl-1,4-butanediol consists of (1) hydroformylating 1,4-butanediol with CO and  $\text{H}_2$  at a  $\text{H}_2/\text{CO}$  molar ratio of at least 0.1, 50–250°C and at an elevated pressure in the presence of a catalytic amount of a phosphine complex of Rh, Co, Ir, or Ru and (2) hydrogenating the hydroformylation reaction product using a conventional hydrogenation procedure. The preferred catalyst for high yields of 2-methyl-1,4-butanediol is a phosphine complex of rhodium, such as  $\text{RhHCO}(\text{PPh}_3)_2$ .

### Condensation of Alcohols

CONTINENTAL OIL CO.

*U.S. Patent 3,860,664*

High molecular weight hydrocarbon alcohols are formed by condensing a reaction mixture consisting of at least one lower molecular weight alkanol having a methylene group adjacent to the hydroxylated C atom, an alkali catalyst and a catalytic amount of a Pd(II) halide or  $(\text{Y})_2\text{Pd}(\text{X})_4$  where Y is ammonium or an alkali metal and X is a halogen.

### Palladium Catalyst for Condensation of Alcohols

CONTINENTAL OIL CO.

*U.S. Patent 3,862,994*

A process of producing higher molecular weight hydrocarbon alcohols consists of condensing at least one lower molecular weight alkanol having a methylene group adjacent to the hydroxylated C in the liquid phase at 80–300°C in the presence of an alkali catalyst and a catalytic amount of a Pd salt while simultaneously removing  $\text{H}_2\text{O}$  as it forms. The alkali catalyst is an alkali metal, alkali metal hydroxide, alkali metal oxide, alkali metal bisulphite or alkali metal hydrocarbon alcoholate and the Pd salt has the formula  $\text{Pd}(\text{RCOCH}=\text{CRO})_2$  where each R is a 1–10C hydrocarbon group.

## Stereospecific Hydrogenation Process

DIAMOND SHAMROCK CORP.

U.S. Patent 3,864,361

A process for hydrogenating 2,5-dimethylpyrrole to 2,5-dimethylpyrrolidine consists of contacting the dimethylpyrrole at 75–160°C and under  $p_{H_2}$  of 200–1,000 p.s.i.g. with 0.2–0.8% of an unsupported  $RuO_2$  as the sole hydrogenation catalyst the  $RuO_2$  having an average crystallite size up to 1,000Å.

## Catalysts for Siloxanes

IMPERIAL CHEMICAL INDUSTRIES LTD.

U.S. Patent 3,867,343

An elastomer composition consists of an organo-hydrogenpolysiloxane, an  $\alpha$ - $\omega$ -dihydroxydi-organopolysiloxane and an organic Pt complex catalyst in which the ligand or donor groups are selected from As, P, S or N and olefins, the groups being capable of donating electrons to form a bond with Pt and a N compound selected from  $NH_3$  and derivatives of  $NH_3$  in which the three valences are satisfied by bonding to an atom selected from, C, H, O, N and Si provided that not more than one O atom is bonded to the ammonia N atom.

## Metal Rhodium Carbonyl Salts

UNION CARBIDE CORP. U.S. Patent 3,878,214

New salts, claimed *per se*, have the formula  $M_2-Rh_{12}(CO)_{30}$  where M is Al, Ga, Ir, Sc, Y or Re in a trivalent state. They may be produced by three different methods from Rh carbonyls and are useful as catalysts in the reaction of CO and  $H_2$  to produce methanol, ethylene glycol, glycerol and propylene glycol.

## CHEMICAL TECHNOLOGY

### Purification of Iridium

U.S. ATOMIC ENERGY COMMISSION

U.S. Patent 3,867,137

A method for purifying Ir consists of oxidising impure Ir to form volatile  $IrO_3$ , decomposing the  $IrO_3$  to condense  $IrO_2$  as a solid at a point away from the oxidising step and reducing the  $IrO_2$  to Ir metal.

### Recovery of Metals from Catalysts

JOHNSON, MATTHEY & CO. LTD.

German Offen. 2,443,146

The metal content of catalysts, e.g. Pt on a cordierite support, is recovered by stripping off a layer containing the metal from the catalyst surface and then processing the product.

### Separation and Purification of Metals

MATTHEY RUSTENBURG REFINERS (PROPRIETARY) LTD.

German Offen. 2,457,672

Pt, Rh and Ir, present as salts in an acidic solution are separated and purified by (a) reducing the Ir(IV) to Ir(III), (b) introducing a secondary or

tertiary amine or quaternary ammonium compound, (c) removing Pt as its complex with the amine by organic extraction, (d) reoxidising the Ir(III) to Ir(IV) with the Rh remaining in solution, (e) adding fresh nitrogen compound to complex the iridium present and (f) extracting the iridium complex. General Mills's Alamine 336 is a suitable amine for both extractions which give a 99% + purity.

## GLASS TECHNOLOGY

### Wired Glass Production

PILKINGTON BROS. LTD. British Patent 1,394,428

As float glass is made, a reinforcing wire, e.g. mild steel wire web, is introduced into the ribbon of glass as it passes under a Pt, Pd, Ru, Ir or other refractory metal flow regulating member which is electrically heated.

## ELECTRICAL AND ELECTRONIC ENGINEERING

### Copper in Noble Metal Metallisation

E. I. DU PONT DE NEMOURS & CO.

British Patent 1,393,646

A balance between cost and performance is struck in printed circuit production by the use of a glass-free mixture of noble metal and/or noble metal oxide with Cu,  $Cu_2O$  or their precursors. The noble metal must be at least 50% Pd, and at least 90% of the particles of both components must be 5  $\mu m$  in size or smaller.

### Electrical Connectors

RAYCHEM CORP.

British Patent 1,395,601

A connector consists of a member pressed against a heat recoverable member which may be made of a Au-Cd alloy,  $ZrPd_xRh_{1-x}$ , etc. The recoverable member is deformed while cold but recovers its shape on heating.

### Resistive Glaze and Paste Compositions

AIRCO INC.

U.S. Patent 3,868,334

A composition for firing into a resistive glaze consists of finely divided  $RuO_2$ , a glass frit consisting of 55–75%  $PbO$ , 2–10%  $ZnO$ , 2–10%  $MnO$ , 5–20%  $SiO_2$ , 5–20%  $B_2O_3$  and 0–5%  $ZrO_2$  and a temporary liquid binder.

## TEMPERATURE MEASUREMENT

### Platinum Probe for a Thermometer

J. M. BRUYERE

German Offen. 2,459,623

An amplifying circuit is used with a thermometer having a Pt probe and a recoupling stage is fitted to the amplifier to compensate for the non-linear change of Pt resistance values with temperature.