metric technique, and *cis-trans* isomerisation was investigated by gas-liquid chromatographic analysis of the reaction products. A new mechanistic theory involving the formation of π-bonded as well as σ-bonded intermediates is supported by experimental results. π-bonding is most evident with Pd films. Although Rh is the most active of the metals for the exchange reactions, σ-bonded intermediates predominate at lower temperatures. As with both Pt and Ni films, π-bonding increases with rise of temperature. (27 references)

## ELECTRICAL ENGINEERING

### The Conductivity of Oxide Cathodes Part 12. Influence of Strontium Ion Migration on Matrix Conductivity

G. H. METSON, *Proc. Instn. Elect. Engrs., Part C*, 1962, **109**, (15), 138-145

The migration of Sr was studied in an S-type assembly having pure Pt cores and a Ba-Sr oxide matrix. It was shown that positive Sr ions migrate in an electric field to the Pt cathode core, forming a Sr-Pt alloy. The positive ions are mobile in a low electric field at 550°K and are unable to diffuse in a concentration gradient below 800°K. Excessive concentration of Sr ions results in an increase in matrix resistivity.

## TEMPERATURE MEASUREMENT

### Reference Tables for 40 Per Cent Iridium-60 Per Cent Rhodium Versus Iridium Thermocouples

G. F. BLACKBURN and F. R. CALDWELL, *J. Res. Nat. Bur. Stds., Part C*, 1962, **66C**, (1), 1–12

The method of calibrating Ir : 40% Ir-Rh thermocouples is described in detail. Temperatures up to 2500°F were measured in a Pt-wound furnace by a Pt : 10% Rh-Pt thermocouple. In the temperature range 1950°–3800°F, calibration was carried out in an induction furnace which contained an Ir cylinder blackbody, and an optical pyrometer was used for temperature measurement. Tables are given which relate e.m.f.s in mV with temperatures in degrees F from 32° to 3800°F and with temperatures in degrees C from 0° to 2100°C.

### A New Method for the Determination of Temperature from the Resistance of a Standard Platinum Resistance Thermometer

S. ALTENBURGER, *Feingeräte Techn.*, 1962, **11**, (3), 116–117

The method described for the determination of temperatures in the range 0° to 630.5°C requires the knowledge of resistance values of the Pt resistance thermometer at only three fixed points. The calculation of thermometer constants and the measurement of resistance at the ice-point are unnecessary.

### A Note on Platinum: Platinum-Rhodium Thermocouple Uncertainty

W. E. BOSTWICK, *I.R.E. Trans. Nucl. Sci.*, 1962, **NS-9**, (1), 253–259

Results are given of tests carried out to determine the effect different types of junction have on the "uncertainty" of temperature measurement of Pt : 10% Rh-Pt thermocouples in the range 1500° to 2800°F. Crimped, twisted, hydrogen arc-welded and resistance welded junctions were investigated. Hydrogen-arc welding was found to be unsatisfactory.

### Thermocouple Materials

F. R. CALDWELL, Nat. Bur. Stds. Monograph 40, Mar. 1, 1962, 43 pp.

Materials considered for thermocouple wires include noble metals and their alloys, base metals and their alloys, refractory metals, carbon and carbides. Among the noble metal combinations described are Pt : Rh-Pt, Rh-Pt : Rh-Pt, Ir : Ir-Rh, Pd : Ir-Pt, and Au-Pd : Au-Pt-Pd. Pertinent chemical, physical and mechanical properties of the separate elements are given and limitations of the thermocouple wires as to range, stability and accuracy are discussed. (128 references)

# *NEW PATENTS*

### Platinum-alumina Catalyst

AMERICAN CYANAMID CO. *British Patent* 894,412

A platinum-alumina reforming catalyst having improved crush strength retentive properties is made by commingling dried ageing alumina, capable of conversion to eta alumina on calcination, with a platinum compound and aluminium chloride, drying the mixture, forming it into pellets and calcining the pellets. The platinum compound is present in proportion of 0.05–1% of platinum based on dry wt. of catalyst and the aluminium chloride in proportion of 0.25–2.5%.

### Fuel Cell

GENERAL ELECTRIC CO. *British Patent* 894,530

A combination electrode structure and electrolyte for a fuel cell is formed of a hydrated ion exchange resin membrane having a gas adsorbing metal electrode embedded in each of the two major surface layers of the membrane. The electrode

consists of platinum or palladium adsorbed on activated electrically conductive carbon.

### Catalyst

ENGELHARD INDUSTRIES INC. *British Patent* 894,612

A catalyst is made of platinum, palladium or rhodium supported on an asbestos cloth carrier. Suitable for use in catalytic heaters and purifiers.

### Manufacture of Carbonyl Compounds

CONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE G.m.b.H. *British Patent* 895,843

Carbonyl compounds are made by treating an organic compound containing one or more carbon-to-carbon double bonds and one or more hetero atoms with an aqueous solution of a platinum group metal compound at 0°–250°C.

### Zirconium Alloy

METALLGESELLSCHAFT A.G. *British Patent* 896,569

An alloy which is highly resistant to corrosion by water and steam at high temperatures and has a low neutron absorption cross-section consists of 0.05–1.5% palladium and remainder zirconium. Minor additions of niobium, iron, chromium, nickel and/or beryllium may be included.

### Electrode Structures

IMPERIAL CHEMICAL INDUSTRIES LTD. *British Patent* 896,912

An electrode structure is formed of a sheet of anodically polarisable metal, e.g. titanium, tantalum or niobium or their alloys in the form of expanded mesh, to the surface of which is secured a platinum group metal (platinum, rhodium or a Pt-Rh alloy). A busbar is secured along one edge of the sheet.

### Electrodeposition of Platinum and Palladium

JOHNSON, MATTHEY & CO. LTD. *British Patent* 897,690

A platinum or palladium plating bath consists of an aqueous solution of a complex nitrito-platinite or nitrito-palladite compound of given general formula. Numerous examples are given, the preferred bath comprising dinitritosulphato platinous (or palladous) acid $H_2Pt$ (or Pd) $(NO_2)_2$. $SO_4$. Methods of preparation disclosed.

### Catalyst for Hydrogen and Oxygen Combination

U.S. ATOMIC ENERGY COMMISSION *British Patent* 897,808

A catalyst for combining hydrogen and oxygen in a thorium oxide slurry is made by forming a thorium oxide sol in an aqueous medium containing 0.05 g (or more) of palladium nitrate per g of thorium oxide and then contacting the sol with gaseous hydrogen until the sol is converted to a flocculated suspension, the resulting suspended solids being recovered.

### Platinum Catalysts

AMERICAN CYANAMID CO. *British Patent* 898,395

Platinum-alumina reforming catalysts are made by impregnating aged alumina (constituting 20–80% of the final alumina content of the catalyst) with a halogen-containing compound to add 0.1–0.5% of the compound, mixing this alumina with dry aged and unimpregnated alumina (constituting 80–20% of the final alumina content of the catalyst), commingling this mixture with a solution of a platinum compound sufficient to give 0.05–1% of platinum in the final catalyst, drying, pelleting and calcining the pellets.

### Oxidation of Olefines to Aldehydes, Ketones and Acids

FARBWERKE HOECHST A.G. *British Patent* 898,790

In the production of aldehydes, ketones and/or acids corresponding to the aldehydes, a hydrocarbon containing an olefinic double bond is contacted in a neutral to acid medium with molecular oxygen and/or an oxidising agent, water and a salt of palladium, iridium, ruthenium, rhodium or platinum in the presence of a redox system.

### Catalysts

THE BRITISH PETROLEUM CO. LTD. *British Patent* 898,972

A catalyst is made by impregnating a refractory oxide containing a platinum group metal with a solution of aluminium halide in an organic water-free solvent, which is subsequently removed. Alumina, aluminium chloride and 0.01–5% by wt. of platinum group metal are used.

### Preparation of Cyclo-hexylsulphamic Acid

ABBOTT LABORATORIES *British Patent* 898,988

Cyclohexylsulphamic acid and salts thereof are prepared by hydrogenating phenylsulphamic acid and its salts in the presence of ruthenium as a catalyst.

### Catalyst

ENGELHARD INDUSTRIES INC. *British Patent* 899,009

A supported ruthenium catalyst is promoted with another platinum group metal, e.g. platinum, rhodium or palladium, the ruthenium content being at least 20 wt.% and up to 95 wt.% of the catalytically active metal. Stated to be advantageous in the hydrogenation of ketones and aldehydes.

### Isomerisation of Paraffin Hydrocarbons

THE BRITISH PETROLEUM CO. LTD. *British Patent* 899,378

A fraction boiling in the range $C_4$–400°F and containing both aromatic and paraffin hydrocarbons is treated to remove most of the aromatics and the aromatic-free fraction is then contacted

in the presence of hydrogen with a catalyst comprising an aluminium halide and platinum or palladium on a refractory oxide support to cause the paraffins in the fraction to be converted into paraffins having a higher degree of branching by isomerisation.

### Hydrogenation of Acetylenes

IMPERIAL CHEMICAL INDUSTRIES LTD. *British Patent* 899,949

Acetylenes are selectively hydrogenated in the presence of olefins by contacting a mixture of at least one acetylene, at least one olefin and hydrogen, sufficient to hydrogenate the acetylenes to olefins, with a catalyst composed of palladium (more than 0.1% but not more than 1%) supported on activated alumina.

### Oxidation of Organic Compounds

ENGELHARD INDUSTRIES INC. *British Patent* 900,107

An olefin, N-alkyl substituted aliphatic amide or cyclic ether is oxidised to, respectively, an aldehyde, ionide or lactone by reacting it with ruthenium tetroxide at a temperature at most not much greater than ambient temperature, e.g. 0–20°C, and in a solvent inert to the action of the tetroxide. The solvent may be water, carbon tetrachloride, chloroform or acetone.

### Decomposition of 1,1-Dimethylhydrazine

ENGELHARD INDUSTRIES INC. *British Patent* 900,453

Unsymmetrical dimethylhydrazine is decomposed by contacting it with a platinum group metal catalyst, supported on a carrier, such as asbestos.

### Combustion Equipment

ROLLS-ROYCE LTD. *British Patent* 900,765

A combustion stabilising device for use with combustion equipment for gas turbines is formed of a V-section member disposed in the combustion space, the sides diverging in the direction of gas flow forming a channel open in the downstream direction and a foraminate platinum or platinum alloy catalyst element extending across the channel.

### Coating for Metals

COMPAGNIE FRANÇAISE THOMSON-HOUSTON *British Patent* 901,292

A protective coating is formed on oxidisable metals by first electrodepositing a layer of rhodium and then a layer of silver. The thickness of the rhodium layer is such that the diffusion of the silver and the base metal through this layer is negligible even during heating.

### Removal of Acetylene from Gases

CONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE G.m.b.H. *British Patent* 902,136

Acetylene and/or other compounds containing at least one carbon-to-carbon triple bond is/are removed from a gas by catalytically contacting the gas with an oxidising agent, e.g. oxygen, in the presence of a platinum group metal compound, preferably a palladium compound, at 50°–170°C.

### Brazing Alloy

GENERAL ELECTRIC CO. *British Patent* 902,521

A high temperature brazing alloy contains 15–40 wt.% chromium, 5–35 wt.% palladium and balance nickel.

### Silver Alloy

U.S. ATOMIC ENERGY COMMISSION *German Patent* 1,119,522

A silver alloy having high neutron-absorption and strength properties contains 0.5–1.5% platinum, ruthenium, rhodium, osmium or palladium, 2–20% indium, with, if desired, up to 10% cadmium and balance of not over 85% silver.

### Thermoelement Alloy

DEUTSCHE GOLD-UND SILBER-SCHEIDEANSTALT *German Patent* 1,119,933

A gold-palladium-vanadium alloy containing 59–68 wt.% gold, 30-39 wt.% palladium and 0.7–2.5 wt.% vanadium is used as the positive limb of a thermoelement.

### Gold Alloys

DEUTSCHE GOLD-UND SILBER-SCHEIDEANSTALT *German Patent* 1,121,339

Workable gold alloys for electric conductors with high specific resistance, such as potentiometer wires, are made of 1–5% titanium 3–8% iron and remainder gold and palladium.

### Method of Making Cyanogen

ROHM & HAAS G.m.b.H. *U.S. Patent* 3,031,265

Cyanogen is made by contacting hydrogen cyanide at at least 300°C with a platinum group metal catalyst.

### Catalyst Manufacture

UNIVERSAL OIL PRODUCTS CO. *U.S. Patent* 3,031,419

A catalyst is made by treating a refractory oxide-platinum group metal (in a reduced valence state) composite with a hydrohalide at 500–650°C, then vaporising a Friedel-Crafts metal halide into the composite and heating the latter at above 400°C to remove any unreacted metal halide.

### Catalysts

AMERICAN CYANAMID CO. *U.S. Patent* 3,032,512

A platinised alumina catalyst is made by leaching pieces of active alumina by contact with a mixture of nitric acid and hydrochloric acid of sufficient strength to react with alumina until 2–15% thereof is solubilised, washing the pieces with water and then impregnating them with an aqueous solution of chloroplatinic acid.