Economical than graphite anodes as the investment and operating costs are lower and they use less electricity. They also give a purer product.

ELECTRICAL AND ELECTRONIC ENGINEERING

Thick-film Conductor Adhesion Reliability


The degradation of adhesion of soldered Pd containing thick-film conductors on exposure to high temperatures was examined. A mechanism is proposed. Adhesion degaradation can be reduced by proper choice of materials and processing conditions.

NEW PATENTS

METALS AND ALLOYS

Dispersion Hardening of Metals

Johnson Matthey & Co. Ltd

U.S. Patent 3,547,712

The mechanical properties of dispersion hardened noble metals or copper are improved by cold working and annealing. The extent of cold working is such that recrystallisation during annealing gives an elongated grain structure highly oriented in the direction of working. Typically the method is applied to Pt or Pt-Rh alloys containing dispersed TiC.

Platinum-Rhodium-Gold Alloys

Johnson Matthey & Co. Ltd

Dutch Appl. 70.08,179

Alloys able to withstand attack by molten glass contain 9-25% Rh, 1-4 wt.% Au and the remainder Pt.

Alloys Containing Pt Group Metals

Johnson Matthey & Co. Ltd

Italian Patent 842,682

A method of making alloys of one or more Pt metals with up to 20 at. % Sc, Ti, V, Y, Zr, Nb, Hf, Ta, or a rare earth metal is described. The Pt metal is melted in a crucible in an Ar atmosphere; the crucible is evacuated when the base metal is added. Rh-Pt-Zr alloys are particularly mentioned.

CHEMICAL COMPOUNDS

Hexaruthenium Octadecacarbonyl

Lonzra Ltd

U.S. Patent 3,542,513

Ru_6(CO)_15 is obtained by heating [Ru(CO)]_6 in a substantially O_2-free atmosphere at 150-250°C and maintaining the CO partial pressure during the reaction at 0.2-2 atm.

Production of Allyl Ruthenium Tricarbonyl Halides

Lonzra Ltd

U.S. Patent 3,546,264

The production of π-allyl Ru tricarbonyl halides is based on the reaction of [Ru(CO)]_6 with allyl halides in an inert solvent under an inert atmosphere. They are used as carbonylation catalysts.

ELECTROCHEMISTRY

Electrolytic Cell

Admiralty Materials Laboratory

British Patent 1,218,938

In a brine electrolysis cell, one electrode is made
of Pt, Pd, Pd-Ag alloy or graphite, and the other of microporous Ag sheets, Cu or Hg.

**Electrochemical Cell**
LEESONA COW. U.S. Patent 3,553,022
A lightweight electrode has a hydrophobic polymer core with an additive, e.g. graphite, to make it conductive. One face of the core is coated with a mixture of catalyst and polymer, e.g. Pt black and ptfe. *U.S. Patent 3,553,024* describes a similar cell electrode.

**Electrochemical Devices**
TECHNICAL OPERATIONS INC. U.S. Patent 3,554,795
Ultra-thin film solid electrolyte devices for batteries, sensors, etc., are described. Vacuum deposition is used to deposit all the layers. A typical cell is Pt/AgI/Ag.

**ELECTRODEPOSITION AND SURFACE COATINGS**

**Electrodeposition of Rhodium**
SEL-REX CORP. *British Patent 1,223,186*
A bright Rh deposit is obtained by the electrolysis of an aqueous solution of a Rh salt, sulphamic acid, and sufficient of a Cu salt to provide a Cu:Rh ratio between 0.05"~ and 5.00"~.

**Metallisation of Titanate Wafers**
R.C.A. CORP. *British Patent 1,227,518*
A conductive coating is formed on the surface of a titanate ceramic sheet by applying a metallising composition. This contains finely divided Pt or Pd (and optionally Ag and/or Au) and a compound which decomposes on heating to give Au, Ag or Hg. Further heating sinters metal to ceramic.

**A Platinum-coated Nickel-Iron-Chromium Alloy Article**
OWENS ILLINOIS INC. *U.S. Patent 3,542,583*
In a process for coating the surface of a Ni-Cr-Fe alloy with Pt, the surface of the alloy is first cleaned to remove all oxides and foreign material and then heated to a temperature of about 500°F. Molten Pt is then sprayed on to the surface at a sufficiently high velocity to rupture any oxides formed on the surface of the base alloy and metallurgically to bond the Pt to the alloy. In this way a strong bond between the alloy and Pt is achieved.

**Electrodeposition of Palladium**
Pd is electrodeposited in a single cell using a bath consisting of an aqueous ammoniacal solution of tetraminopalladous bromide having a pH of 9-10. Ductile coatings suitable for electrical contacts are produced.

**Electrodeposition of Thick Coatings of Palladium**
U.S. SECRETARY OF THE INTERIOR
*U.S. Patent 3,547,789*
Thick adherent coatings of Pt, Pd or alloys of Pt and Pd with other Pt metals are obtained by passing current through a molten cyanide or cyanide-cyanate bath exposed to O2 at 350-600°C. The current is passed from Pt or Pd electrodes to the article to be plated.

**Rhodium Plating Baths**
DEUTSCHE GOLDF- UND SILBER-SCHIEDEANSTALT
*German Appl. 1,922,421*
Thick, crack-free, bright Rh coatings are obtained from baths in which Rh is at least partly complexed with S compounds. See also *French Patent 2,030,835*.

**HETEROGENEOUS CATALYSIS**

**Platinum Catalyst**
W. R. GRACE & CO. *British Patent 1,218,334*
HCN is produced by the reaction of NH3 with a saturated hydrocarbon (e.g. CH4) in the presence of 0.01-2.0 wt.% of Pt on a refractory mullite base.

**Ammonia-dissociation Catalyst**
GENERAL ELECTRIC co. *British Patent 1,224,565*
A catalyst for the dissociation of NH3 consists of Ir or an alloy of Ir with e.g. Pt, Ti, Ta, Fe or Ni.

**Reforming Catalyst**
CHEVRON RESEARCH co. *British Patent 1,226,071*
A catalyst for the low-pressure reforming of hydrocarbons consists of a porous inorganic oxide carrier with 0.01 to 3 wt.% of Pt, 0.01 to 5 wt.% of Re and 0.1 to 3 wt.% of a halogen.

**Hydrogenation Catalyst**
BRITISH PETROLEUM CO. LTD
*British Patents 1,226,131 and 1,226,132*
A catalyst particularly useful for the production of fuel oils from waxy residues consists of a mordenite partly ion-exchanged with a Pt group metal. Pt or Pd are preferred.

**Reforming Catalyst**
UNIVERSAL OIL PRODUCTS CO.
*British Patent 1,226,807*
Supported Pt is used in one of the stages of production of aromatic hydrocarbons from petroleum fractions.

**Catalytic Dewaxing**
CHEVRON RESEARCH co. *U.S. Patent 3,539,495*
A waxy hydrocarbon oil feed is catalytically dewaxed in the presence of H2 using a catalyst of 0.01-3% Pt and 0.01-5% Re on a porous solid carrier.
Oxidation of Ferrous Compounds and Reduction of Ferric Compounds

A continuous method of oxidising ferrous compounds to ferric compounds and of reducing ferric compounds to ferrous compounds by the use of a supported Pt group metal catalyst in a trickle column is described. These reactions offer a route to the recovery of Fe contained in, for example, $\text{H}_2\text{SO}_4$ and $\text{HCl}$ solutions.

Hydrocarbon Conversion Catalyst

Hydrocarbons are converted in contact with a catalyst consisting of Pt and Re on a support. The support contains $\text{Al}_2\text{O}_3$ and finely divided mordenite and is made by mixing the components in an aqueous medium in the presence of a source of halogen.

Aromatic Hydrocarbon Production

Aromatic compounds are produced by contacting a mixture of $\text{H}_2$ and hydrocarbons with a supported mixture of 0.1-1.0% Pt, 0.1-1.0% Pd and 5-25% Cr$_2$O$_3$.

Naphtha Reforming

Naphtha is reformed over a supported catalytic mixture containing 0.01-3% Pt and 0.001-1% Ir in the presence of less than 15 ppm S.

Hydrocarbon Conversion Catalyst

A hydrocarbon conversion catalyst consists of Ru, Rh, Pt or Pd deposited on an $\text{Al}_2\text{O}_3$ which has been activated with an organic chloride.

Hydrocracking Catalyst

A hydrocracking catalyst consists of a crystalline zeolitic molecular sieve cracking component, 0.01-2.0% Pt, Pd or Ir or their compounds and 0.01-2.0% of Re or its compounds. See also U.S. Patents 3,558,475, 3,558,477 and 3,558,479.

Hydroreforming Catalysts

New catalysts consist of a support, such as $\text{Al}_2\text{O}_3$ or a zeolite, of specific surface $15 \text{ m}^2/\text{g}$ or more and pore volume greater than $0.1 \text{ cm}^3/\text{g}$ carrying 0.02-2% Pt metal and 0.02-2% Pb, Ge and/or Sn.

Olefin Production

Normal olefins are produced from n-paraffins by contact at high temperature with a supported mixture of Pt and Cd.

Removal of Oxides of Nitrogen from Waste Gases

Waste gases produced in the manufacture of $\text{HNO}_3$ are combined with a gaseous reducing fuel and passed over a supported mixture or alloy containing 50-80% Pt and 50-20% Rh in order to remove oxides of NH$_3$. A preferred reducing fuel is $\text{CH}_4$. With 35% Rh-Pt, ignition temperatures as low as 315°C are attainable.

Removal of Organic Pollutants from Waste Gases

Organic compounds (including CO and hydrocarbons) which are present in waste gases and which otherwise cause atmospheric contamination are oxidised to CO$_2$ and H$_2$O by passage, together with $\text{O}_2$, over a supported mixture or alloy containing 50-80% (by weight) Pt and 50-20% Rh. Significantly improved results with a wide range of organic contaminants and with internal combustion engine exhausts are claimed.

HOMOGENEOUS CATALYSIS

Hydrogenation Catalyst

Aldehydes or ketones are converted to alcohols by $\text{H}_2$ in the presence of a carboxylic acid and a mixed-ligand complex of Ir. The ligands may be PPh$_3$ or AsPh$_3$.

Hydroformylation Catalyst

A catalyst medium for hydroformylation is a solution of a coordination complex of Rh, in which at least one of the ligands is halogen and one a tertiary amine, phosphine, arsine or stibine (MR$_3$). A stoichiometric excess of at least 2 moles of MR$_3$ is present per mole of Rh complex. A heterogeneous vapour phase system is also described.
Organosiloxane Compositions

GENERAL ELECTRIC CO.  U.S. Patent 3,539,530

An organopolysiloxane having terminal organosiloxy units is reacted with a silicon hydride in the presence of a Pt catalyst, e.g. H₂PtCl₆.

Silane Addition Reactions

IMPERIAL CHEMICAL INDUSTRIES LTD  U.S. Patent 3,546,266

Organic Si compounds are produced by olefin addition to a Si-H bond in the presence of a Rh catalyst of formula RhX(RR'R''Y)₃, where X is an anion and the R's are organic groups. Y is As, Sb or P.

Oxalic Acid Production

AMERICAN CYANAMID CO.  U.S. Patent 3,555,084

Oxalic acid is produced when acetylene is oxidised with an alkali metal ferricyanide and OsO₄ or an alkali metal osmiate.

Unsaturated Compound Reactions

G. WILKINSON  French Patent 1,601,798

Unsaturated compounds are hydrogenated, hydroformylated or carbonylated to give aldehydes or ketones in the presence of a Pt metal halide or pseudohalide complexed with a PPh₃, where one phenyl group has electron-donating substituents. In one example RhCl₃ is complexed with tri-(paramethylphenyl) phosphine. A phosphine: Rh ratio of 2:1 is preferred.

Dehydration of Alcohols

STE USINES CHIMIQUES RHONE-POULENC  French Patent 2,029,290

Alcohols which do not have any unsaturation on the α-C atom are dehydrated to ethers and/or olefins over Group VIII noble metal catalysts, especially Ru, Rh or Os acetylacetonates or other complexes.

Ruthenium Carboxylates

JOHNSON MATTHEY & CO. LTD  Dutch Appl. 70.10,315

A new composition of matter is a Ru carboxylate of formula Ru₃(OCOR)₄, where R is an optionally substituted alkyl or aryl group. It is produced by heating together a soluble Ru salt, a soluble carboxylate and the corresponding carboxylic acid, e.g. acetic acid. The compounds may be stabilised by complexing them with pyridine or a phosphine. Protonation with strong acids produces species showing high activity for the catalysis of hydrogenation and other reactions.

Transition Metal Carboxylate Catalysts

JOHNSON MATTHEY & CO. LTD  Dutch Appl. 70.10,375

Transition metal compounds useful for catalysis are obtained by complexing a Pt group metal or other transition metal carboxylate, thiocarboxylate or dithiocarboxylate with a stabilising ligand. In one example a Rh benzoate catalyst is stabilised by a phosphine. Protonation of these compounds with strong acids produces species of the type M⁺⁺⁺ (where M is the transition metal used) showing a high activity for the catalysis of hydrogenation and other reactions. Preferred Pt group metals are Rh and Ru.

Homogeneous Hydrogenation of Olefins

JOHNSON MATTHEY & CO. LTD  Italian Patent 851,328

A (PPh₃)₃ClRh complex which has a CH₃ or methoxy group in the p position of the Ph groups is used as a catalyst for the hydrogenation of olefins such as cyclohexene, hex-1-ene, cis- or trans-4-methylpent-2-ene.

Improved Hydroformylation Catalysts

JOHNSON MATTHEY & CO. LTD  Italian Patent 859,655

Catalysts such as RhH(CO)(MR₃)₃ where M is P, As or Sb, and R is aryl, alkyl or aralkyl radicals are used for the hydroformylation of olefinically unsaturated compounds. The reaction is carried out in an aldehyde or alcohol solvent in the presence of a base.

FUEL CELLS AND BATTERIES

High-capacity Metal/Air Battery

LEBSONA CORP.  British Patent 1,221,196

In a high capacity metal/air battery, one face of the cathode member is coated with a catalyst which is a uniform mixture of Pt and Pt.f.e. particles.

Fuel Cell Electrode

GENERAL ELECTRIC CO.  British Patent 1,221,981

A fuel cell electrode consists of a mixture of a noble metal (i.e. Rh, Ru, Pd, Os, Ir or Pt or mixtures or alloys thereof) with a W bronze.

Fuel Cell

GENERAL ELECTRIC CO.  British Patent 1,224,932

Fuel for a fuel cell is provided by gases from the dissociation of NH₃ on an Ir or Ir alloy catalyst.

Fuel Cell

GENERAL ELECTRIC CO.  British Patent 1,227,762

A fuel cell consists of an air electrode, an air oxidant, an electrolyte, an NH₃ fuel and a catalytic fuel electrode which is a Pt-Ir alloy containing at least 20% by weight of Ir.

Electrically Conductive Hermetic Seals

WESTINGHOUSE ELECTRIC CORP.  U.S. Patent 3,555,667

Structural members, e.g. in fuel cells, are sealed using a Pt-Au sandwich. The members are each coated with Pt and the central bonding layer consists of Au or an alloy of Au with 18% Ni.
CHEMICAL TECHNOLOGY

Sheathed Metals
JOHNSON MATTHEY & CO. LTD
British Patent 1,222,434
In the sheathing of a base metal such as Mo or W with a Pt group metal, migration of the base metal to the sheathing metal is reduced by evacuating the intervening space and introducing an inert gas such as Ar, N₂ or He. The invention also includes the use of a barrier layer of refractory oxide, nitride or carbide which prevents physical contact between the core and the sheath.

Titanium Tetrachloride Heating
LAFORTE TITANIUM LTD U.S. Patent 3,554,708
TiCl₄ is heated by passage through heating tubes having inlets and outlets made of Pt or an alloy of Pt with Rh, Ru or Ir.

Contact Furnace for Gas Oxidation
FRIEDRICH UHDE G.m.b.H.
German Appl. 2,029,484
A contact furnace for gas oxidation using Pt and Rh has mineral wool mats at intervals behind the catalyst zone to collect the vaporised catalyst.

GLASS TECHNOLOGY

Containers for Molten Glass
PILKINGTON BROS. LTD British Patent 1,222,248
A container for molten glass has its inner glass-contacting surfaces made of Ir or an alloy containing at least 50% Ir and its outer surfaces coated with Rh.

Spinneret for Glass Fibres
PILKINGTON BROS. LTD French Appl. 2,029,484
A spinneret for glass fibres is made in two parts. The body is made from an alloy of 5-40% Rh, 0-20% Ir and the remainder Pt, the total content of Rh and Ir being not more than 40%. The working faces across which the fibres are drawn are made from an alloy of up to 60% Pt, 0-25% Rh, 0-20% Ir, 2-10% Au, 0-5% Cu and 0-10% Pd, the total content of Rh and Ir being not more than 25%.

ELECTRICAL AND ELECTRONIC ENGINEERING

Composite Electrode
K.D.I. CHLORO GUARD CORP. U.S. Patent 3,547,600
A three component electrode having enhanced resistance to high voltage damage is described. It may particularly be used for chlorinating and hypochlorinating. It consists of a Ti or Nb body, an intermediate layer of 0.003-0.005 inch of Pt, Rh, Ir, Ru or their alloys.

Resistive Film
BOURNS INC.
U.S. Patent 3,551,355
A resistive film for a potentiometer consists of a glass frit and 1-7% of Ru conductive particles.

Resistor Oxide Compositions
E. I. DU PONT DE NEMOURS & CO.
U.S. Patent 3,553,109
New resistors have the composition \((M_xBi_{1-x})(M_yRu_{1+q})O_{1-z}\), where \(M\) is Y, Ti, In, Cd, Pb or a lanthanide, \(M'\) is Pt, Ti, Sn, Cr, Rh, Ir, Re, Zr, Sb or Ge, \(x = 0-2\), \(y = 0-2\) and \(z = 0-1\). This mixed oxide is combined with an inorganic binder, a noble metal and a binary oxide. A typical resistor contains 22-76% Bi₂Ru₂O₇, 15-64% binder, 3-30% Au and 0.5-5% CoO.

Indirectly Heated Cathode
U.S. PHILIPS CORP.
U.S. Patent 3,553,521
An indirectly heated cathode has a refractory metal support, such as Mo or W, coated with a Pt metal to minimise oxidation. Rh, Ir and Ru are the preferred metals.

Methanol Combustion Anode
ROBERT BOSCH G.m.b.h.
German Appl. 1,546,693
Anodes for the electrochemical combustion of methanol, particularly in fuel cells, have a catalyst consisting of an alloy of Ru with one or two other Pt metals and/or Au.

Condenser Cathode
ERO-TANTAL-KONDENSATOREN G.m.b.h.
German Appl. 2,020,778
A condenser cathode is formed of Cu or Ag or their alloys and is coated with a non-porous layer of Au or Pt or a Au-Pt alloy.

TEMPERATURE MEASUREMENT

Temperature Sensitive Bridge Circuits
N. R. DAVIS
British Patent 1,222,379
A bridge circuit incorporates a temperature sensor element, e.g. a Pt resistance element.

High Stability Sheathed Thermocouple
JOHNSON MATTHEY & CO. LTD
German Appl. 2,022,322
A noble metal thermocouple is insulated by MgO or BeO₂, has air or any other oxidising medium removed and is protected by an inert gas. The sheath contains a “getter” such as Ti, Zr or Ta which maintains oxidising potential at a low level. It may also contain a small percentage of the more volatile components of the noble metal limbs.