

ABSTRACTS

of current literature on the platinum metals and their alloys

PROPERTIES

Precipitation Hardening in Platinum-Iridium Alloys

E. RAUB and W. PLATE, *Z. Metallkunde*, 1956, 47, Oct., 688-693

Describes X-ray and microscopic investigations on the whole range of Pt-Ir alloys after differing heat treatment together with resistance and expansion measurements on the alloys containing 10-50% Ir. The Pt-Ir alloys are shown to solidify without exception in solid solution with a broad miscibility gap at lower temperatures having its highest point at about 975° C and 50% Ir and extending from 7-99% Ir at 700° C. Precipitation hardening results from this immiscibility in alloys containing 10-90% Ir; however, as equilibrium is reached only very slowly, this is difficult to detect by X-rays and becomes ultimately impossible below 700° C. Hardness and resistivity changes are observed after short tempering periods.

The System Uranium-Palladium

J. A. CATTERALL, J. D. GROGAN and R. J. PLEASANCE, *J. Inst. Metals*, 1956, 85, Oct., 63-67

The experimental procedures used in investigating the system U-Pd are described. The results are illustrated by a phase-diagram and photomicrographs and show the presence of a eutectic between U and UPd, a stable compound UPd₃ and two other compounds UPd and U₂Pd₆ formed by peritectic reaction. The solubility of Pd in U is slight, but up to 38% U dissolves in the δ solid solution which forms from UPd₃ by peritectic reaction.

The Electronic Properties of Ni-Pd Alloys

E. P. WOHLFARTH, *J. Phys. Chem. Solids*, 1956, 1, Sep./Oct., 35-38

A theoretical discussion of the magnetic properties of Ni-Pd alloys based on the collective electron treatment of ferromagnetism together with suggestions for suitable experimental work to test the theoretical conclusions.

Preliminary Electrical-Resistivity Measurements of the Ni-Pd Alloy System

A. I. SCHINDLER, R. J. SMITH and E. I. SALKOVITZ, *J. Phys. Chem. Solids*, 1956, 1, Sep./Oct., 39-41

Describes electrical resistivity measurements on a range of Ni-Pd alloys at various temperatures.

The results show a maximum resistivity at about 70% Pd and the theoretical implications of this are discussed.

The Hall Effect in the Ag-Pd Alloy System

A. I. SCHINDLER, *J. Phys. Chem. Solids*, 1956, 1, Sep./Oct., 42-44

Room temperature Hall coefficient measurements on the Ag-Pd alloy system are described; divergences from normal behaviour are obtained which cannot be explained using any of the known multiband models for the Hall coefficient.

Decay of Neutron-Deficient Isotopes of Pd and Rh

S. KATCOFF and H. ABRASH, *Phys. Rev.*, 1956, 103, No. 4, 966-970

Pd isotopes of masses 98, 99 and 101 were prepared by α-particle bombardment of Ru. The radiations of these isotopes and of their Rh daughters—masses 98, 99 and 101—were investigated with a scintillation coincidence spectrometer.

ELECTROCHEMISTRY

Investigation into the phase-group impedance in noble metal electrodes in the region of hydrogen adsorption

III "New" activated Rh and Au electrodes
M. BREITER, H. KAMMERMAIER and C. A. KNORR, *Z. Elektrochem.*, 1956, 60, No. 5, 454-462

Experiments performed on these new electrodes are described. The new Rh electrode is shown to behave differently from Pt, Ir and the older type of Rh electrode in that it has a lower H₂ adsorption, and the graphs relating H₂ overvoltage to resistivity etc. also show significant differences.

The Mechanism of the Electrolytic Evolution of Oxygen on Pt

J. O'M. BOCKRIS and A. K. M. SHAMSHUL HUQ *Proc. Roy. Soc.*, 1956, A237, Oct. 9, 277-296

Describes work on the kinetics of the electrolytic oxygen evolution reaction on bright Pt anodes in H₂SO₄ solutions under ultra-pure conditions over the concentration range 10⁻³ to 10⁻¹ N and in the presence of varying amounts of Na₂SO₄. The current density ranged from 10⁻¹¹ to 10⁻³ A cm⁻². Investigations were also carried out on the

attainability of a reversible oxygen electrode, the time variation of oxygen overpotential at constant current density, its decay with time on open circuit and the cathodic ionisation.

ELECTRODEPOSITION

Some Experimental and Practical Aspects of Heavy Rhodium Plating

F. H. REID, *Bull. Inst. Metal Finishing*, 1956, 6, No. 2, 107-142

Describes the results of laboratory work carried out on the thick plating of Rh from sulphate and phosphate-sulphate electrolytes, together with some exploratory work on phosphate, fluoborate and sulphamate baths. Experimental techniques are described for the preparation of the electrolytes and the examination of the deposits with reference to thickness, adhesion to basis metal, surface condition, incidence of cracking, internal stress and hardness.

Details are given of the results obtained for the sulphate and phosphate-sulphate electrolytes in terms of quality of the deposits under varying deposition conditions. The effect of variants in the basic methods of preparing the electrolytes was studied and it was found that, except in the case of hardness, there was no correlation between the properties of the deposit and the various methods of preparation examined. In both electrolytes the freshly prepared solutions gave very highly-stressed deposits showing a high incidence of cracking and had low cathodic efficiencies, but after ageing the cathodic efficiencies improved together with the quality of the deposits. These results showed that for thick Rh plating the acid sulphate electrolyte has advantages over the phosphate bath in respect of a higher cathodic efficiency together with rather lower internal stress and greater hardness of the deposits. It is also easier to maintain since the quality of the deposits is very little affected by the build up of free sulphuric acid which occurs when the bath is replenished. Of the other three electrolytes studied the exploratory results indicate that the phosphate and fluoborate baths have no advantages over the sulphate, but that the sulphamate bath merits further consideration since it offers a wider range of deposition temperatures over which smooth deposits can be maintained.

The factors influencing the cracking of the deposit are examined in detail. Internal stress can be influenced by the deposition conditions, particularly temperature, but under conditions of equal stress the incidence of cracking tends to be reduced when the Rh is deposited on a soft unstressed metal surface. Under typical deposition conditions it is shown that no cracking occurs up to 0.0002 to 0.0003 in., a range which incorporates the major proportion of industrial Rh plating. For thicker deposits cracking is reduced by lowering the internal stress, but in all known

cases this can only be done at the expense of the surface smoothness of the deposit.

The importance of a correct treatment of the basis metal surface is emphasised, and techniques are described for Rh and Ag/Rh plating the most common of these.

The Electroplating of Palladium

E. R. THEWS, *Metalloberfläche*, 1956, July, 193-196
A general review of the development, properties and uses of Pd as an electroplating material. It includes sections on the main processes used in obtaining a satisfactory deposit, and on the various types of plating baths.

LABORATORY APPARATUS AND TECHNIQUE

The Accurate Determination of Methane

B. DOMANSKI, A. JOURDAN and C. EYRAUD, *Chim. anal.*, 1956, 38, Sep., 322-327

Describes an improved apparatus for the determination of methane based on the change in resistance of a Pt filament during the catalytic combustion of the gas. The apparatus has been adapted as a portable unit which is described in detail. Identical Pt-10%Rh filaments form two arms of a Wheatstone bridge circuit, one filament is used as the catalyst in the combustion of the gas to be determined which is passed over it in strictly regulated amounts, while the other is used as a standard resistance. The roles of the two filaments can be interchanged thus eliminating the inevitable drift in readings obtained by using only one filament. The apparatus has been used for two thousand measurements lasting a minute each, with great accuracy and sensitivity, without the filaments showing any sign of needing replacement.

The Behaviour of $O_2 - H_2O_2 - H_2O$ on Bright and Platinised Pt

D. WINKELMANN, *Z. Elektrochem.*, 1956, 60, (7), 731-740

Describes experiments on the electrochemical behaviour of H_2O_2 ; the cathodic reduction of O_2 and the oxidation and reduction of H_2O_2 on Pt were investigated. Experimental procedure and results are given, and reaction mechanisms postulated.

The Metallographic Preparation of Noble Metal Samples by Cutting with a Microtome

G. REINACHER, *Z. Metallkunde*, 1956, Sep., 607-613
Describes experiments on the preparation of slides of Ag, Au, Pd, Pt and some heterogeneous Ag alloys by cutting with a microtome instead of by the usual method of grinding with emery paper. The advantages of the method are enumerated.

A Simple and Inexpensive Large Area Rotating Pt Electrode

J. K. JOHANNESSON, *Chem. & Ind.*, 1956, Oct. 20, 1141-1142

Describes a very satisfactory large area rotating Pt electrode for use in amperometric titrations. It is prepared by coating a glass bulb blown at the end of a glass tube with a thin conducting film of Pt, electrical contact being made by means of a Pt wire sealed through the glass.

Precious Metal Coated Bombs for High Temperature Studies

R. M. BIDWELL, W. R. WYKOFF, B. J. THAMER and C. D. ROSS, *Nucleonics*, 1956, 14, Oct., 71-77

The adaptation of stainless steel bombs for use with corrosive solutions at high temperatures by cladding with Pt or Au is described. Pt is used almost exclusively because of its superior mechanical properties and the fact that it can be soldered with pure Au. Full details are given of the cladding of a delta-sealed bomb and a smaller test-bomb with Pt, and also of the development of an Au plated bomb for studying the recombination of hydrogen and oxygen formed in radiolysis in a reactor fuel solution. The limitations of the bombs due to the differing thermal expansion of stainless steel from those of Pt and Au are discussed, and a method of testing for defects in the precious metal coating is described.

METAL WORKING

Study of the Effect of Gases on the Melting, Casting and Working of Palladium

R. H. ATKINSON, *J. Met.*, 1956, 8, No. 8, 1029-1035

Experiments were carried out on Pd and an alloy of 95.5% Pd, 4.5% Ru, to find the effect of oxidising, inert and reducing atmospheres on their melting, casting and working.

Several different linings were used for the crucibles in which the metals were melted, these were: proprietary MgO, alundum, zircon, ZrO₂ and fused MgO and Al₂O₃. The gases used as deoxidisers in the melting of Pd were: H₂, CO, city gas, C₂H₂, tank gas and commercial CH₄. Gases other than reducing gases whose effects were tested were: N₂, air, steam, He, A, O₂ and CO₂. In judging the quality of the metal after melting and working, the principal criteria were density, hardness and freedom from blisters after annealing.

Detailed tabulated results are given. It is shown that H₂ has serious disadvantages as a deoxidiser since it tends to introduce impurities into the melt by attacking the crucible lining, thus giving very hard Pd. It can be used when the crucible lining is MgO or MgO cement, but it still tends to form a pitted surface because of the formation of steam at the surface causing the Pd to blister when annealed in air. These disadvantages

are lessened by using the intermittent deoxidation technique in which the Pd or Pd alloy is melted in a He or A atmosphere and H₂ is applied intermittently at intervals of a few seconds. CO is a satisfactory deoxidiser for Pd, but with the alloy some gas was retained in the metal giving rather low densities. All the other gases which were tried caused excessive blistering of the metal when annealed in air.

Air was found to be unsatisfactory as an annealing atmosphere since it contains free O₂ which forms a subscale of oxide. H₂ can be used but it gives a very hard metal which is difficult to work, as well as tending to aggravate any existing blisters; it is satisfactory, however, when diluted to about 10% with N₂. CO also has disadvantages as an atmosphere because of the H₂ present as impurity. The best annealing atmospheres were found to be: He, A, steam, CO₂, N₂ or N₂/10%H₂ (suitable for most industrial alloys).

The solubility of various gases, namely O₂, air, N₂, steam, CO₂, He and A in molten Pd were investigated, and it was found that steam and O₂ were very soluble, He appreciably so, and even A was soluble to some extent. The investigation of the diffusion of gases in solid Pd showed that the order of increasing rate was: inert gases <N₂, CO₂ <O₂. In a separate experiment H₂ was shown to diffuse about 10 times as fast as O₂.

CATALYSIS

Studies of the Strength of Poison-to-Catalyst Bonds. Part I: Heats of Adsorption of Ethyl Sulphide and Thiophen on Platinum

E. B. MAXTED and M. JOSEPHS, *J. Chem. Soc.*, 1956, Aug., 2635-2639

It is known that near room temperature catalyst poisons are reversibly chemisorbed on to the catalyst surface, and in this paper the strength of the bonds involved is found by measuring the differential heat of adsorption for two typical poisons, ethyl sulphide and thiophen. The values obtained were 65-70 k. cal. per mole for ethyl sulphide and about 33 k. cal. for thiophen; the difference is presumed to be due to thiophen losing its resonance structure on adsorption. Both values are considerably greater than that for H₂, 18-20 k. cal., as would be expected.

Catalytic Hydrogenation of m-Nitroacylbenzenes to m-Alkylanilines

H. OELSCHLÄGER, *Chem. Ber.*, 1956, Sept., 2025-2029

M-alkylanilines, previously only obtainable with difficulty, can be formed easily and in good yield by hydrogenation of m-nitroacylbenzenes in the presence of palladium-black in glacial acetic acid with sulphuric acid monohydrate as activator.

Penex-Platforming of Naphthas

ANON. *Petrol. Process.*, 1956, **11**, No. 8, 66-67
Describes Universal Oil Products Company's recently developed Penex isomerisation process for increasing the octane content of naphthas. A fixed-bed Pt containing catalyst in a hydrogen-atmosphere is used; the catalyst does not need regeneration, and only a single heater and single reactor are needed. With recycle operation, product yields of around 99.5% can be obtained.

Electronic Theory of Catalysis (I) Metals

J. E. GERMAIN, *Bull. Soc. chim. Fr.*, 1956, Parts 8-9, 1305-1313

A general review of the literature on the electronic theory of catalysis as applied to metals, from the point of view of electronic structure and chemisorption. The effect of alloying the metals, and of their texture, is discussed, as are catalytic supports and promoters. Pt and Pd are among the examples cited. (60 references.)

The Dehydrogenation of Ethane at Low Pressure on Incandescent Pt

D. J. FABIAN and A. J. B. ROBERTSON, *Proc. Roy. Soc.* 1956, **A237**, Sep. 25, 1-16

Describes experiments carried out on the reaction of ethane on a Pt filament at temperatures between 1300 and 1800° K and from 10⁻⁴ to 10⁻⁷ mm. On a freshly prepared filament both ethylene and ethyl radicals are formed but after a short while the reaction stops due to poisoning of the catalyst by formation of a carbonaceous layer on its surface. The reaction proceeds again in the presence of water, or if the filament is heated in oxygen. The reaction mechanism and theoretical aspects of the phenomena observed are discussed in detail.

The Reactions of Ethylene with Deuterium over Various Types of Pt Catalyst

G. C. BOND, *Trans. Faraday Soc.*, 1956, **52**, Sep., 1235-1244

Describes experiments carried out on Pt pumice, platinised Pt foil, Pt-Al₂O₃, Pt-SiO₂ and Pt-Al₂O₃-SiO₂ to discover whether the kinetics of a typical heterogeneous reaction are affected by the type of catalyst used. Experiments were carried out on each catalyst to discover the course of the reaction at 0°C, and the effect of temperature and partial pressure variation. Detailed tabulated results are given which show little difference in the behaviour of the catalysts. The kinetics of the addition and exchange reactions are discussed.

Platforming—a Means of Upgrading Motor Fuels in Natural Gasoline Plants

R. F. COX and R. H. KILLGORE, *Oil Gas J.*, 1956, **54**, Oct. 1, 74-77

Describes a plant installed by the Southwest Gas Producing Co. Inc. and Feazel Interests in which

a platforming unit is used in conjunction with a natural gasoline condensate recovery plant, affording a method of upgrading the motor fuel fraction from the plant from an octane number of 82.5 to one of 95-98. The output from the plant may vary considerably from day to day and a system is described whereby the rate of flow over the Pt catalyst is kept constant in order to avoid any deleterious effects. Tables are included showing the results obtained with this plant in terms of the characteristics and component distribution of the reformat.

Oxidation of Methane in a Homogeneous Phase by Air or "Active" Oxygen on Incandescent Pt

C. EYRAUD, B. DOMANSKI and P. BUSSIÈRE, *Compt. rend.*, 1956, **243**, (13), 905-907

Experiments carried out indicate that the catalytic oxidation of methane over Pt takes place at least partially in the homogeneous phase by means of oxygen desorbed from the surface of the catalyst in an active state.

Heats of Adsorption of O₂ on Ni, Pt and Ag

O. D. GONZALEZ and G. PARRAVANO, *J. Amer. Chem. Soc.*, 1956, **78**, Sept. 20, 4533-4537

The adsorption of O₂ is studied on powdered Ni, Pt and Ag samples in the temperature range 150-300°C and surface coverings 10⁻⁴ to 10⁻³. Results showed that the behaviour of Pt and Ag was very similar, but Ni showed certain differences. This suggests that the O₂ chemisorption is not directly related to the electronic structure of the metals, providing a contrast to H₂ adsorption.

Investigations on Catalysis XIV. Catalytic Oxidation of p-Cymene at Room Temperature

Z. CSUROS, I. GECZY and J. MORGOS, *Acta Chim. acad. sci. Hung.*, 1956, **10**, (1-3), 193-205 (In English)

Experiments are carried out on the course and kinetics of the heterogeneous oxidation of p-cymene at room temperature using Pd-C, Pd-BaSO₄ and CuO-BaSO₄ catalysts. Detailed results are given in the form of graphs and tables. No oxidation is obtained with CuO-BaSO₄ but Pd-C and Pd-BaSO₄ were both found to be satisfactory catalysts.

CATHODIC PROTECTION

Platinum Anodes more Economical than Alloy Platinum-Palladium, NACE Task Group Concludes

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, *Corrosion*, 1956, **12**, Jul., 86

Describes the use of Pd-Pt alloys for testing as anodes in cathodic protection systems on the

hulls of ships. The lowest corrosion rate was recorded for the 90%Pt-Pd alloy, but since pure Pt was found to be more economical the use of the alloy was not recommended. Details of the properties of Pt anodes are given together with information on a new type of foil anode consisting of the alloy 80%Pt-Pd.

ELECTRICAL ENGINEERING

Selecting Materials for Electrical Contacts— Materials & Methods Manual No. 130

V. G. MOORADIAN, *Mat. & Methods*, 1956, 44, Sep., 121-140

This manual tackles the problem of the choice of contact materials for various applications under the headings: evaluation of operating conditions, evaluation of life and reliability requirements, selection of basic contact material, and determination of contact design. Under the first two headings the mechanical and physical properties required from the material under various conditions are discussed. A chart of contact materials used for specific applications is given. The Pt metals feature prominently in this, they or their alloys being used among other things for contacts in thermostats, instruments, magnetos, motors and telephone equipment. The selection of the basic contact material is aided by a chart giving the advantages, disadvantages and applications of the common contact materials, alloys of Pt and Pd with Ir, Rh, Ru, Os and Au are resistant to oxidation at high temperatures and are capable of maintaining low contact resistance over long periods.

ELECTRONICS AND TELECOMMUNICATIONS

Thermionic Emission Constants of Ir

D. L. GOLDWATER and W. E. DANFORTH, *Phys. Rev.*, 1956, 103, No. 4, 871-872

The thermionic emission constants of polycrystalline Ir are measured with reasonable care, using thin ribbons of Ir as the emitting specimens. The values of the constants A and ϕ obtained experimentally were:

$$A = 170 \text{ amp cm}^{-2} \text{ deg C}^{-2}$$

$$\phi = 5.40 \text{ v}$$

Brazing Molybdenum and Tungsten Cathode Parts with Ruthenium

J. P. JASIONIS and J. E. CLINE, *Inst. Radio Eng. Trans.*, Electron. Devices, 1956 (3), 162

In the development of thoria-coated indirectly heated magnetron cathodes operating above 1500° C the problem arises of joining Mo and W. Several metals were proposed as brazing media and Ru was found to be the best, although

Os and Ir are worthy of investigation. Brazing was carried out in 80% N₂ and 20% H₂ at 2100° C, the brazing medium consisting of Ru powder or a mixture of Ru and Mo powders. A eutectic melting at about 1900° C was formed between Ru and Mo allowing Ru to be used in a brazing operation below its normal melting point and safely below the melting point of Mo.

TEMPERATURE MEASUREMENT

Recent Developments in Temperature Measurement and Control

T. LAND, *Metallurgical Rev.*, 1956, 1, Part 2, 271-288

An excellent critical review incorporating all recent developments of interest to the metallurgist. Summarised information on available methods of temperature measurement is given in tabular form. Brief reference to the standard 10 and 13% Rh-Pt:Pt thermocouples is followed by more details on special couples for high temperatures, including the 1%Rh-Pt:13%Rh-Pt, 5%Rh-Pt:20%Rh-Pt and 20%Rh-Pt:40%Rh-Pt. Protection of couples for use in liquid metal temperature measurement is also discussed. A section on gas-temperature measurement describes suction pyrometers in which the gas is drawn past the thermocouple. (28 references.)

The Industrial Measurement of Gas Temperature

A. M. GODRIDGE, R. JACKSON and G. G. THURLOW, *Trans. Soc. Instrum. Tech.*, 1956, 8, (3), 103-124

A critical review of the instruments at present used in industry with some original work on the development of new techniques. The most widely used instrument is the sheathed Pt:Rh-Pt thermocouple, but this is known to be inaccurate although it is extremely consistent and is ideal for control work where a knowledge of the true temperature is unimportant. Instruments now being developed are described, including the suction pyrometer, total heat meter and pneumatic pyrometers. Most work has been done on the suction pyrometer and a new design now being marketed is described in which the Pt-metal thermocouple unit can be fitted with different heads for use under various conditions. The authors have developed a pneumatic pyrometer with venturi openings in place of orifices; this has many advantages over previous designs and is shown to have potentialities as a commercial continuous recording instrument. It has no upper temperature limit and a very quick response which give it advantages over the suction pyrometer. The difficulties encountered and the relative use of the various instruments in the temperature ranges <1000°C, 1000-1400°C, and >1400°C are described.

Suction Pyrometers in Theory and Practice

T. LAND and R. BARBER, *J. Iron Steel Inst.*, 1956, 184, Nov., 269-273

The factors to be considered in designing an efficient suction pyrometer are discussed. A commercially available instrument is described comprising a Pt:Pt-13%Rh thermocouple surrounded by radiation shields and incorporating

devices for controlling and measuring the velocity of the gas. The optimum velocity is shown to be about 500 ft./sec. and the efficiency at various temperature levels is maintained by altering the number of radiation shields; it has been found advantageous to enclose these in a water-cooled jacket for use in open-hearth furnace uptake where there is a danger of overheating and slag attack.

NEW PATENTS

Reductive Alkylation of Organic Compounds

UNIVERSAL OIL PRODUCTS CO. *British Patent* 753,740

An organic compound having an amino or nitro group substituent is reacted, together with a ketone or aldehyde and hydrogen in the presence of a platinum-containing catalyst (not over 2% by weight Pt).

Dehydroisomerisation of Naphthenes

N.V. DE BATAAFSCHE PETROLEUM MAATSCHAPPIJ *British Patent* 753,783

C₅ ring naphthenes are converted to the corresponding aromatic hydrocarbons by treatment, in the presence of hydrogen, at 420°C to 570°C, with a catalyst having a surface area greater than 300 sq. metres/gram and consisting of silica gel promoted with 0.1-0.8% alumina and 0.1-1% platinum.

Hydroforming

ESSO RESEARCH & ENGINEERING CO. *British Patent* 754,041

Hydroforming is carried out with the use of a fluidised desulphurisation catalyst which absorbs the sulphur removed and gives an H₂S-free naphtha product.

Hydroforming Catalyst

ESSO RESEARCH & ENGINEERING CO. *British Patent* 754,552

A hydroforming catalyst consists of 0.01-2% by weight of finely divided metallic platinum or 0.5-5% finely divided palladium supported on pure crystalline alumina. The alumina is prepared by heating beta alumina trihydrate to 750-1500°F. The catalyst is made by impregnating the crystalline alumina with a solution of a platinum or palladium salt, drying and calcining.

Recovery of Platinum from Catalytic Materials

AMERICAN CYANAMID CO. *British Patent* 755,487

Platinum-alumina catalytic material is digested with sulphuric acid. The alumina goes into solution and platinum remains in suspension. The platinum is flocculated and separated.

Cyclisation of Pentamethylene Diamine

IMPERIAL CHEMICAL INDUSTRIES LTD. *British Patent* 755,534

Piperidine is made by contacting pentamethylene diamine in vapour state at elevated temperature (300-500°C) with a catalyst consisting of platinum (5%) on pellets of silica gel. An inert gas is preferably passed through the reaction zone.

Reforming of Gasoline Fractions

UNIVERSAL OIL PRODUCTS CO. *British Patent* 755,709

A gasoline fraction containing arsenic impurities is first freed of impurities by contact with an initial portion of a noble metal catalyst at 125-425°C and is then reformed during contact with another portion of the catalyst at 440-650°C. Catalyst comprising alumina, 0.1-8% of fluorine or chlorine and 0.1-1% platinum is referred to.

Electrical Contacts

JOHNSON, MATTHEY & CO. LTD. *British Patent* 756,393

A rivet-type electrical contact is made from a disc-like blank. A hollow shank is formed by extruding part of the material of the blank, the remaining unextruded part forming the contact operating face. The blank may consist of solid metal, such as platinum or palladium, or of bi-metal, i.e. a base metal backing, e.g. copper, and a precious metal facing layer.

Hydroforming

ESSO RESEARCH & ENGINEERING CO. *British Patent* 756,798

A hydroforming process in which the treated material, withdrawn from the hydroforming zone, is fractionated and the part boiling between 225°C and 300°C is recycled to the hydroforming zone. A platinum group metal-on-alumina catalyst is used, e.g. 0.05-5% platinum or 1.5-10% palladium by weight.

Platinum Catalysts

N.V. DE BATAAFSCHE PETROLEUM MAATSCHAPPIJ *British Patent* 756,902

A platinum catalyst includes also a minor portion each of aluminium fluoride and aluminium