

ABSTRACTS

of current literature on the platinum metals and their alloys

PROPERTIES

The Constitution Diagram of the Ruthenium-Rhenium-Osmium System

E. M. SAVITSKII, M. A. TYLKINA and V. P. POLYAKOVA, *Zhur. Neorg. Khim.*, 1963, 7, (1), 146-148

The phase diagram was constructed after a study of the system by thermal, microstructural and X-ray analysis and by hardness measurements. Both cast and heat-treated specimens were examined. It was found that Ru, Re and Os form a continuous series of liquid and solid solutions. The hardness of the ternary alloy increases with decreasing Re content, maximum hardness occurring in the alloy with 20 at.% Ru, 20 at.% Re and 60 at.% Os.

An Investigation of the Palladium-Iron-Copper Alloy System

A. T. GRIGOR'EV and G. V. POZHARSKAYA, *Zhur. Neorg. Khim.*, 1963, 7, (1), 141-145

The ternary system was examined by thermal and microstructural analysis. Polythermal sections were drawn of alloys with constant Pd content of 10 to 80 at.% (in increments of 10 at.% Pd) and of Pd-Cu:Fe=1:1 alloys, and a theoretical constitution diagram for the system was constructed. Alloy structure after annealing and quenching confirmed the assumption that the chemical compound Pd₂FeCu exists in two modifications.

Ruthenium-Vanadium Alloys

E. RAUB and W. FRITZSCHE, *Z. Metallkunde*, 1963, 54, (1), 21-23

Alloys in the full range of composition were examined by X-ray and microscopic methods. The existence of two intermediate phases, one with the b.c.c. CsCl structure and one with a slightly distorted tetragonal CsCl lattice, was confirmed. Phase boundaries of the Ru-rich solid solution and the intermediate phases were determined.

Liquidus-Solidus Relations in Iron-rich Alloys of the Systems Iron-Technetium, Iron-Osmium, Iron-Iridium and Iron-Gold

R. A. BUCKLEY and W. HUME-ROTHERY, *J. Iron Steel Inst.*, 1963, 201, (2), 121-124

Alloys were prepared and the liquidus, solidus and γ - δ transformation temperatures of the four Fe-rich systems were determined. Slow rates of heating and cooling were used for the thermal analyses. Results are tabulated for each system and phase diagrams are shown. Both Os and Ir act as

austenite-stabilisers when alloyed with Fe and their addition raises the δ - and γ -liquidus curves. Tc acts as a very weak ferrite-stabiliser. Equilibrium diagrams of 26 Fe-rich alloys are compared.

The Constitution of the Ruthenium-Cerium System

W. OBROWSKI, *Z. Metallkunde*, 1962, 53, (11), 736-737

Alloys of the system, prepared by induction melting *in vacuo* or in an Ar atmosphere, were examined by thermal analysis and by microscopic and X-ray methods in both the cast and heat-treated states. Hardness measurements were also made. ϵ -Ru-rich and β - and γ -Ce-rich solid solutions occur and the intermetallic compound Ru₂Ce is formed peritectically at 1570°C. A eutectic alloy is formed at 645°C between Ru₂Ce and β -Ce-rich solid solution.

Germanium-Ruthenium Alloys

E. RAUB and W. FRITZSCHE, *Z. Metallkunde*, 1962, 53, (12), 779-781

The alloy system was studied by microscopic and X-ray examination and, partly, by thermal analysis. No evidence was found of the formation of solid solutions, but the intermediate phases GeRu and Ge₃Ru₂ were identified. GeRu melts congruently at 1475°C and is isostructural with FeSi (B20-type). Ge₃Ru₂, with 60 at.% Ge, forms, probably peritectically, at about 1460°C and has tetragonal crystal structure. The phase diagram constructed shows the formation of a eutectic alloy between RuGe and Ru at 41 at.% Ge.

Production and Properties of Grain-Stabilised Platinum and Platinum Alloys

J. R. KNIGHT and B. TAYLOR, *Powder Metallurgy*, 1962, (10), 108-118

Methods of producing thoriated material by powder metallurgy and pure thermo-element Pt ("Fibro") by the "bundled-wires" technique are described. Results are given of room temperature tensile tests made on thoriated 10% Rh-Pt wire and of stress-rupture tests in the range 1250° to 1460°C on thoriated 10% Rh-Pt and "Fibro" Pt wire. Both the thoria-stabilised alloy and "Fibro" Pt, compared with normal melted material, show improved strength up to about 1500°C. Ductility of thoriated 10% Rh-Pt is low. The fibrous structure of the grain-stabilised materials is discussed.

The Oxidation Behaviour of Titanium, Niobium and Their Alloys

M. K. MCQUILLAN, *Corrosion et Anticorrosion*, 1962, **10**, (11), 361-378

The high-temperature oxidation of Ti and Nb and the factors by which it is influenced are discussed fully. The effect on the various oxidation processes of alloying with transition metals has been examined. It is shown that alloying with Ru reduces the solubility of oxygen in Nb and Ti and reduces the rate of diffusion of oxygen through Nb, especially at lower temperatures.

Alloys of Ruthenium with Boron, Beryllium and Aluminium

W. OBROWSKI, *Metall*, 1963, **17**, (2), 108-112

Alloys were produced in an induction furnace under Ar and were examined by metallographic, X-ray and thermal analysis. Phase diagrams of the three binary systems were prepared and the molten- and solid-state equilibria were studied. Phases shown in the Ru-B system are a Ru-rich solid solution, Ru₃B₃, RuB, Ru₂B₃ and RuB₂. In the Ru-Be system, Ru- and Be-rich solid solutions and the phases Ru₂Be₃, RuB₂, Ru₃Be₁₀, RuBe₁₃ were found. The Ru-Al diagram shows a Ru-rich solid solution and the intermetallic compounds RuAl, Ru₂Al₃, RuAl₂, RuAl₃, RuAl₄, and RuAl₁₂. The crystal structure and hardness of most of these phases was measured. Nineteen photo-micrographs are reproduced.

New Orthorhombic Phase in the Ruthenium-Boron and Osmium-Boron Systems

R. B. ROOF and C. P. KEMPTER, *J. Chem. Phys.*, 1962, **37**, (7), 1473-1476

Single-crystal and polycrystalline X-ray diffraction studies confirmed the existence of isomorphous orthorhombic lattices in the Ru-B and Os-B systems with probable empirical formulae RuB₂ and OsB₂. Lattice parameters are: a₀ = 4.6443 ± 0.003 Å, b₀ = 2.8668 ± 0.0008 Å, c₀ = 4.0449 ± 0.0004 Å, and a₀ = 4.6832 ± 0.0001 Å, b₀ = 2.8717 ± 0.0002 Å, c₀ = 4.0761 ± 0.0001 Å, respectively.

The Preparation of Alloys of Platinum with Base Metals

W. BRONGER and W. KLEMM, *Z. anorg. allgem. Chem.*, 1962, **319**, (1/2), 58-81

Mixtures of the Pt metal powder and powdered base metal oxides were reduced by hydrogen or NH₃ at temperatures between 900° and 1200°C to form the intermetallic phases: Pt₃Al, Pt₁₃Al₃, Pt₃Sc, Pt₅Y, Pt₅La; Pt₁₃Be, Pt₃Mg, Pt₇Mg, Pt₂Ca, Pt₇Ca₂, Pt₅Ca, Pt₃Sr, Pt₅Sr; Pt₇Li and Pt₃Cr. The structures of these alloys were elucidated and the transitions between the alloys with Ca were studied. The stereochemistry of alloys of Pt with elements of Groups I to III is discussed and the results are tabulated.

Superconductivity and Lattice Structure of Titanium-Rhodium Alloys

W. BUCKEL, G. DUMMER and W. GEY, *Z. angew. Phys.*, 1962, **14**, (12), 703-706

Alloys with 5, 10, 12.5 and 15 at.% Rh were prepared and lattice constants were measured. The transition temperature of alloys in the range 2-10 at.% Rh is 4°K, but for alloys with >10 at.% Rh it is lower. These results are discussed in relation to the structure of the alloys.

Superconductivity of Chromium Alloys

B. T. MATTHIAS, T. H. GEBALLE, V. B. COMPTON, E. CORENZWIT and G. W. HULL, *Phys. Rev.*, 1962, **128**, (2), 588-590

Cr-Ru, Cr-Rh and Cr-Ir alloys were shown to possess superconducting properties dependent on their composition and valence-electron concentration. Transition temperatures for h.c.p. 50 at.% Cr-Ru, σ-phase Cr₂Ru and β-W phase Cr₃Ru are 1.65°, 2.0° and 3.3°K, respectively. Cr-Rh h.c.p. alloys in the range 25 to 80 at.% Cr are superconducting with a maximum transition temperature of 1.1°K at 70 at.% Cr. The h.c.p. Cr-Ir alloy with 72 at.% Cr and the β-W type 85 at.% Cr-Ir alloy have transition temperatures of 0.83° and 0.77°K, respectively. Ferromagnetism was shown to occur in the Cr-Ir system and in cold-worked Cr-Rh with about 60 at.% Cr.

The Crystal Structure of ThPt and Some Related Compounds

J. R. THOMSON, *Acta Cryst.*, 1962, **15**, (12), 1308-1309

X-ray studies of ThPt and ThRh showed that they are isostructural, having the CrB structure. Structural data are given for the isotypes: ThCo, ThRu, ThRh, ThIr, ThPt and ThAl.

Structures of Compounds in the MSb₂ Group: CoSb₂, RhSb₂, IrSb₂, and α-RhBi₂

G. S. ZHDANOV and R. N. KUZ'MIN, *Soviet Phys. Cryst.*, 1962, **6**, (6), 704-711 (Transl. of *Kristallografiya*, 1961, **6**, (6), 872-881)

Retigraph patterns of isomorphous crystals of these compounds were measured using Mo radiation. Results show their structure to be monoclinic of the FeAsS type.

Conductivity and Hall Constant. XXIV. Gold-Palladium-Vanadium Alloys

W. KÖSTER, H.-P. RAVE and Y. TAKEUCHI, *Z. Metallkunde*, 1962, **53**, (12), 749-753

Au-Pd-V alloys with 9 at.% V were studied. The dependence of electrical resistivity, Hall constant, and their temperature coefficients upon alloy composition, previous heat treatment and mechanical working was established. The absolute thermo-electric power of several alloys in the full range was measured at room temperature. Short-range ordering associated with a strong K-effect

is shown by alloys in the medium composition range. After slow cooling they have greater resistivity and a lower Hall constant than when cold-worked or quenched.

Heat Content of Platinum

W. B. KENDALL, R. L. ORR and R. HULTGREN, *J. Chem. Eng. Data*, 1962, 7, (4), 516-518

A diphenyl ether calorimeter was used with various Pt samples and the expression $H_T^0 - H_{298.15}^0 = 0.0006425T^2 + 5.796T - 1785$ was derived for the heat content in cal/g-atom °K. New thermodynamic values for Pt, from 298.15°K to 2043°K, are tabulated.

Thermoelectric Power of Quenched Platinum

J. POLÁK and K. MÍSEK, *Czech. J. Phys.*, 1962, 12, (6), 492-493

The thermo-e.m.f. of a couple made of annealed and quenched Pt wire (99.6% pure) was measured with one junction at room temperature and the other at -160°C. The dependence of the thermo-e.m.f. of the couple on the cold junction temperature, was found to be similar to that of a couple made of annealed and 13%-deformed Pt wires.

Magnetism of Dilute Solutions of Iron-Group Elements in Platinum Metals

R. M. BOZORTH, D. D. DAVIS and J. H. WERNICK, *J. Phys. Soc. Japan*, 1962, 17, Suppl. B-I, 112-114
Ferromagnetic Curie points and magnetic moments of dilute alloys of Mn, Fe, Co and Ni in Pd and Pt were determined. Pd was partially replaced by Rh, Ag or Cu in some of the alloys. Experimental results confirm the existence of a Co-Pd complex in the Co-Pd alloys and that there is Co-Pd and Pd-Pd interaction within the complex. Weaker complex formation also exists with Fe, Ni or Mn in Pd or Pt, and Co in Pt. Critical concentration limits for the addition elements, below which ferromagnetism does not exist, were observed.

Invar Behaviour and Magnetic Moments of the γ -Phase of Iron-Palladium Alloys

A. KUSSMANN and K. JESSEN, *J. Phys. Soc. Japan*, 1962, 17, Suppl. B-I, 136-139

This investigation with quenched Pd-Fe alloys showed that the γ -phase has high values of magnetostriction and that a minimum of the thermal expansion coefficient exists at 30 at.% Pd. This γ -phase retains its ferromagnetic character nearly up to pure γ -Fe. It is concluded that the presence of a non-magnetic region is not necessary for the existence of an invar effect.

Magnetic and Other Properties of Some Binary Palladium Alloys

E. KUDIELKA-ARTNER and B. B. ARGENT, *Proc. Phys. Soc.*, 1962, 80, (5), 1143-1148

Binary Pd alloys containing up to 20 at.% V, Nb, Ta, Zr or Mo were prepared in an argon-arc

furnace and measurements of their magnetic susceptibility, electrical resistivity and lattice parameters were made. The variation of these properties with alloy composition shows qualitative agreement with the predictions of a simple band model. Varying alterations in the band shapes may occur on alloying with different elements.

Magnetic Interactions in Palladium-rich Alloys with Some Transition Elements

J. P. BURGER, *J. Phys. Radium*, 1962, 23, (8/9), 530-532

Measurements were made of the magnetic susceptibility of alloys of Pd with small amounts of Fe at varying degrees of hydrogenation. The susceptibility decreases rapidly and linearly during hydrogenation until the Pd d-band is full, after which the residual magnetic moment is due to the Fe. The two main effects of hydrogenation are lowering of the ferromagnetic Curie point and diminution of saturation magnetisation.

Specific Heat of Metallic Palladium between 65° and 105°K

J. CRANGLE and T. F. SMITH, *Phys. Rev. Letters*, 1962, 9, (3), 86-87

Specific heat measurements made on 99.96% pure Pd showed no anomalous peak in the experimental temperature range. They do not confirm the occurrence of an antiferromagnetic Néel temperature at about 90°K suggested by magnetic susceptibility measurements on Pd by other workers.

Field-Emission Study of Composite Adsorption Layers on Tungsten and Platinum

W. J. M. ROOTSAERT, L. L. VAN REIJEN and W. M. H. SACHTLER, *J. Catalysis*, 1962, 1, (5), 416-431

Physical adsorption of Xe on W and chemisorption of hydrogen, CO, and HCOOH on W and Pt were studied in a field-emission microscope. Surface potentials were determined and heats of adsorption of complexes on crystal faces were derived from measured desorption rates. Emission patterns, after chemisorption, showed a greater surface heterogeneity on W than on Pt. The heats of adsorption of Xe and most of the chemisorbed complexes showed a topographic dependence which was more pronounced on b.c.c. (W) than on f.c.c. (Pt) crystals. The distribution of the adsorbate over the total surface and the concept of an "induced" heterogeneity are discussed.

Surface Structure and Electrochemical Potential of Palladium while Absorbing Hydrogen in Aqueous Solution

P. C. ABEN and W. G. BURGERS, *Trans. Faraday Soc.*, 1962, 58, (10), 1989-1992

Electrochemical potential measurements were made on fine-grained Pd wire electrodes immersed

in 2N H₂SO₄ as hydrogen at atmospheric pressure was absorbed. A Pt/hydrogen reference electrode was used. The surface structure of the electrodes was examined by X-ray diffraction at 12 points in the course of absorption, and α -, ($\alpha+\beta$)-, and β -Pd-H phases were identified. Lattice parameters of the phases were measured. Correlation between the potential curve and surface structure confirmed the successive formation of α -, ($\alpha+\beta$)- and β -Pd-H phases during absorption.

A Thermodynamic Study of Hydrogen in Palladium

P. MITACEK, *Diss. Abs.*, 1962, 23, (3), 853

Experiments showed that the heat capacities of samples with H:Pd atomic ratios from 0.125 to 0.75 are the same over the temperature range 35° to 85°K and that a transition occurs at 55°K on the heat capacity curve. A model proposed to explain the effect involves the formation of square planar PdH₄ molecules in sheets of planes of H and Pd atoms. Warm drifts, dependent on hydrogen concentration, were found for some ratios. Calculations of the PdH₄ molecular heat capacity agreed with experimental values from 35° to 250°K.

Aromatic Complexes of Metals. Part 67. Cyclopentadienyl-iridium-dicarbonyl

E. O. FISCHER and K. S. BRENNER, *Z. Naturforsch.*, 1962, 17b, (11), 774-775

The preparation of C₅H₅Ir(CO)₂ and its identification are described.

ELECTROCHEMISTRY

Voltammetric and Chronopotentiometric Study of the Anodic Oxidation of Methanol, Formaldehyde and Formic Acid

R. P. BUCK and L. R. GRIFFITH, *J. Electrochem. Soc.*, 1962, 109, (11), 1005-1013

The reaction sequences and rates of limiting processes in the anodic oxidation of these fuel cell reactants were determined. Current-potential curves with linearly changing potential were obtained in 14 aqueous electrolytes ranging from 10 M KOH to 9 M H₂SO₄, with fuel concentrations ranging from 0.01 to 0.1 M. A platinised Pt sphere anode was used in the electrolysis cell. The effect of pH on the current-potential curves, peak currents, overpotentials, and kinetic parameters was determined and chronopotentiograms were produced.

The Performance of Hydrocarbons in Ion Exchange Membrane Fuel Cells

L. W. NIEDRACH, *J. Electrochem. Soc.*, 1962, 109, (11), 1092-1096

C₃H₈, C₃H₆, C₂H₄, CH₄ and CO were tested as fuels in an ion exchange membrane fuel cell. The

electrodes consisted of thin layers of Pt or Pd black bonded on to the surface of a resin electrolyte, with 80 mesh Pt gauzes buried in the electrolyte surfaces to serve as current collectors. In all cases, fuel performance was better on Pt than on Pd. Efficiency was improved at increasing temperatures over the range 27°-85°C. None of the fuels was superior to pure hydrogen.

Anodic Oxidation of Methanol on Platinum. II. Interpretation of Potentiostatic Current-Potential Curves in Acidic Solution

S. GILMAN and M. W. BREITER, *J. Electrochem. Soc.*, 1962, 109, (11), 1099-1104

Low sweep-rate periodic potentiostatic current-potential curves were produced using a smooth Pt electrode, 1N HClO₄ electrolyte and CH₃OH concentrations of 0.01 M to 1 M at 30°C. Curve forms depend on the CH₃OH and oxygen coverage of the Pt surface. The oxidation of CH₃OH is faster when electrode coverage by CH₃OH is low. Single curve forms obtained at different sweep rates indicate two partial CH₃OH oxidation currents.

Dissolution of Oxygen Layers on Platinum in Chloride Solutions

M. W. BREITER and J. L. WEININGER, *J. Electrochem. Soc.*, 1962, 109, (12), 1135-1138

The dissolution at open circuit of oxygen layers formed at 1.4 and 1.6 V in 1N H₂SO₄ was studied at 25° and 85°C in 0.2N HCl + 0.1M NaCl and 0.2N HCl + 2.8M NaCl. A mechanism suggested for the dissolution process involves the simultaneous cathodic reduction of oxygen and anodic dissolution of Pt at the same electrode.

Effect of Concentration and Temperature on the Overpotential of Oxygen on Platinum Anodes in Sulphuric Acid Solutions

T. ERDEY-GRÜZ and O. GOLOPENCSA-BAJOR, *Acta Chim. Acad. Sci. Hung.*, 1962, 34, (3), 281-289 (In German)

The investigation was carried out in the temperature range 0° to 40°C in H₂SO₄ solutions ranging from 0.05 to 27.81 M. The polarisation curves obtained show that the temperature, overpotential and concentration affect the partial processes to a different extent. Experimental conditions affect the reaction kinetics at the Pt anode differently in three current density ranges. The mechanism of electrolytic oxygen liberation is discussed.

Separation Factor of Deuterium on a Platinum Hydrogen Electrode in Aqueous Sulphuric Acid

M. FUKUDA and J. HORIUTI, *J. Res. Inst. Catalysis, Hokkaido Univ.*, 1962, 10, (1), 43-72.

The electrolytic separation factor of deuterium on a Pt/H electrode was observed at 15°C in 1.34 N H₂SO₄ containing 8.49 at. % deuterium under a hydrogen pressure of 12 cm Hg and with hydro-

gen overvoltages ranging from 0.02 to 0.55 V. The separation factor was determined by measuring the deuterium content of the electrolyte and of the hydrogen electrolysed at constant voltage. Results obtained verify the prediction that the hydrogen electrode reaction changes from an electrochemical to a catalytic mechanism with increasing voltage, and that as this occurs the separation factor rises from about 3 to about 7.

Studies of Hydrogen-Chlorine Fuel Cell. I. Basic Studies of the Hydrogen-Chlorine Fuel Cell at Low Temperature

S. YOSHIZAWA, F. HINE, Z. TAKEHARA and Y. KANAYA, *J. Electrochem. Soc. Japan*, 1962, **30**, (1), E10-E16
Hydrogen electrodes of graphite, porous C, or porous C impregnated or plated with Pt or Pd catalysts, were studied. It was found that ionisation of hydrogen occurs on Pt/C or Pd/C, but not on C alone. Ionisation of chlorine takes place easily on porous C. The equilibrium potential of the cell decreases with increase of HCl concentration and of electrolyte temperature. The cell operates most efficiently with an impregnated Pt/C hydrogen electrode in 5 to 8 N HCl at a high temperature ($\sim 50^\circ\text{C}$).

The Effect of the Composition of the Solution upon the Diffusion Rate of Electrolytic Hydrogen through a Metal Diaphragm

L. D. KOVBA and I. A. BOGOTSKAYA, *Zhur. Fiz. Khim.*, 1963, **37**, (1), 161-168 (English summary)
The rate of hydrogen diffusion through Pd was measured for solutions of $\text{N H}_2\text{SO}_4$, $\text{N H}_2\text{SO}_4 + 0.03 \text{ N KI}$, $\text{N H}_2\text{SO}_4 + 5 \times 10^{-8} \text{ M}[(\text{C}_4\text{H}_9)_4\text{N}]_2\text{SO}_4$ and $\text{N H}_2\text{SO}_4 + 0.03 \text{ N KI} + \text{sat. } (\text{C}_4\text{H}_9)_4\text{NI}$, and the effect of Hg poisoning of Pd was determined. It is suggested that hydrogen diffuses through poisoned Pd in one stage with discharge of the hydrogen ion. The change in the amount of molecular hydrogen evolved at a poisoned Pd surface affects the hydrogen overvoltage. The irreversibility of the discharge stage and of the removal of adsorbed hydrogen was shown.

LABORATORY APPARATUS AND TECHNIQUE

A Comprehensive Thermal Analysis Apparatus

A. A. HODGSON, *J. Sci. Instr.*, 1963, **40**, (2), 61-65
This apparatus was built from commercial units and specially designed furnaces. In the differential thermal analysis furnace, working temperatures up to 1150°C are measured by Pt:13% Rh-Pt thermocouples. The thermal gravimetric analysis furnace is vertical, and the sample is placed in a Pt bucket which is suspended within the furnace from the beam of a recording thermobalance by a Rh-Pt alloy wire. Both furnaces are

designed for programmed heating rates and use with inert or oxidising atmospheres.

A Gradient Furnace with Platinum-Rhodium Windings for Temperatures up to 1700°C

M. PERNICA, *Silikáty*, 1962, **6**, (3), 311-313
The furnace, with two concentric tubes, has two 30% Pt-Rh windings, the inner in the middle of the furnace and the outer extending along its whole length. The construction of the furnace and the method of obtaining the required temperature gradient are described.

An Improved Design of a Platinum Cell for Dielectric Measurements

S. K. SATYANARAYANA and S. SOUNDARARAJAN, *J. Sci. Ind. Res. India*, 1962, **21D**, (7), 248-249
The cell consists of two concentric Pt cylinders 10 cm long, with the internal radius of the outer and the external radius of the inner cylinders 1.6 and 1.9 cm, respectively. The Pt is 0.2 cm thick. A Housekeeper's glass seal is used to hold the cylinders in position. The cell has an electrical capacity of $40 \mu\text{F}$ and a liquid capacity of 130 ml. Details of construction are given. A method of platinising glass cells is also described.

METAL WORKING

The Development of Palladium Brazing Alloys

D. W. RHYS and R. D. BERRY, *Metallurgia*, 1962, **66**, (398), 255-263
Alloys were selected for evaluation as brazing materials after phase-boundary determinations had been made on the following systems: Pd-Ag-Cu, Pd-Ag-Al, Pd-Ni-Ag, Pd-Ag-Mn, Pd-Ni, Pd-Ni-Cu, Pd-Ni-Mn, Pd-Ni-Cr, Pd-Ni-Ti and Pd-Cu-Au. The workability and brazing properties of alloys from all these systems except Pd-Ni-Ag were investigated. Short-time shear tests and stress-to-rupture tests were made on joints made with several of the alloys on 18/8 stainless steel and Nimonic alloys. The Pd alloys showed good wetting, flow and gap-filling properties and had little erosive action on the materials brazed. Joint strengths at high temperatures were satisfactory.

CATALYSIS

Results of a Further Study of the Decomposition of Nitrous Oxide on Platinum Catalysts

L. RIEKERT and M. STAIB, *Z. Elektrochem.*, 1962, **66**, (8/9), 735-739
Electrically-heated physically pure Pt wire and foil catalysts were used in this investigation. Reproducibility of the reaction was easily attained and was not affected by pre-annealing of the catalysts in oxygen, hydrogen or steam. Decom-

position was retarded by added oxygen and by oxygen formed during the reaction. Slight contamination of the catalysts resulted in loss of reaction reproducibility. Results are discussed with reference to earlier work on the decomposition of HCOOH and to *p*-hydrogen conversion.

High Pressure Hydrogenation with Rhodium-Platinum Oxide

S. NISHIMURA and H. TAGUCHI, *Bull. Chem. Soc. Japan*, 1962, **35**, (9), 1625-1626

(7:3) Rh-Pt oxide catalyst was used in the hydrogenation of several unsaturated organic compounds in CH₃COOH under hydrogen pressures of 70 to 100 kg/cm². Most of the reactions were rapid at room temperature and it was shown that the rate of hydrogenation of C₆H₆ increases greatly with increased pressure. Increase of temperature to 50°C also increases reaction rates. The catalyst has greater activity and stability under high pressures than PtO₂.

Studies on the Silk-Rhodium Catalyst

A. AKAMATSU, Y. IZUMI and S. AKABORI, *J. Chem. Soc. Japan*, 1962, **35**, (10), 1706-1711

A hydrogenation catalyst of optimum activity was obtained when 400 mg of silk-fibroin was boiled for about 30 minutes with 30 ml of 0.5% aqueous RhCl₃ solution and the chelate produced was hydrogenated. The activity was maintained or increased on storage. The catalyst was poisoned by PhCH₂SH and Fe⁺⁺⁺ and Cu⁺⁺ ions, but reactivated by treatment with EDTA. Tests with various organic compounds showed that the catalyst is very active for the hydrogenation of C=CHCH₂OH and C=CHCOOH types of double bonds, but not for carbonyl groups. It is less active for the hydrogenation of other types of C=C double bonds and of nitro groups.

The Use of Rhodium Salts for the Polymerisation of Butadiene

R. E. RINEHART, H. P. SMITH, H. S. WITT and H. ROMEYN, *J. Amer. Chem. Soc.*, 1962, **84**, (21), 4145-4147

It has been shown that Rh(NO)₃ catalyses the polymerisation to the *trans* polymer in H₂O and in alcohol, but RhCl₃ is effective only in H₂O in the presence of an anionic emulsifier. The rate of polymerisation is linear with time and is dependent on catalyst concentration. Rh salts act as inhibitors for the free-radical emulsion polymerisation. They also catalyse, in aqueous emulsion, the isomerisation of *cis*- and *trans*-polybutadiene toward an equilibrium structural composition.

Studies on Tritium-labelled Compounds. VI. The Platinum-catalysed Exposure Technique

T. MESHI and T. TAKAHASHI, *Bull. Chem. Soc. Japan*, 1962, **35**, (9), 1510-1514

Charcoal, Pt black, and Pd black catalysts were applied to the salicylic acid/T₂ system to increase the labelling efficiency of the tritium. Catalyst

efficiency was in the order: Pt > Pd >> C. Specific activities were increased 3~1880 times by using Pt black in the labelling of six organic compounds. Aromatic compounds were more readily labelled by this method than were aliphatic compounds. The function of the catalyst is discussed.

Processes for the Manufacture of Nitric Acid

G. DRAKE, *Brit. Chem. Engr.*, 1963, **8**, (1), 12-20

Current commercial processes for the production of dilute HNO₃ by NH₃ oxidation, and the influence of operating temperatures and pressures, are discussed. A process employing high-pressures for NH₃ oxidation and NO₂ absorption is described in detail. Other processes which operate at medium pressures or combinations of high-, medium- or low-pressures are outlined and their special features are emphasized. The operating efficiency of the 10% Rh-Pt gauze catalysts used for the NH₃ oxidation reaction is described. Reduction of tail gas from the absorber over Pt, Ru or Pd catalysts, using hydrogen or a hydrocarbon fuel, is also discussed.

The Isomerisation of Light Petroleum Fractions Using Promoted Reforming Catalysts

H. KÖGLER, S. QUECK, H. WAGNER and G. WEIDENBACH, *Chem. Techn.*, 1962, **14**, (10), 596-599

Results of laboratory and full-scale tests show that the isomerisation activity of Pt/Al₂O₃ catalysts is increased by their treatment with an HF/H₃BO₃ mixture. Both fresh and regenerated reforming catalysts may be promoted in this way.

The Role of Dehydrogenation Activity in the Catalytic Isomerisation and Dehydrocyclisation of Hydrocarbons

J. H. SINPFLT, H. HURWITZ and J. C. ROHRER, *J. Catalysis*, 1962, **1**, (5), 481-483

Pt/Al₂O₃ catalysts containing 0.1, 0.3 and 0.6% Pt were used in the conversion of *n*-heptane and methylcyclopentane, and the reaction products were analysed. Reaction rates were also determined as a function of Pt content. Over the Pt range the rate of isomerisation of *n*-heptane was constant, but the dehydrocyclisation rate increased by 75 to 100%. The rate of isomerisation-dehydrocyclisation of methylcyclopentane increased by about 10% (i.e. within limits of error) with increase of Pt from 0.3 to 0.6%.

Kinetics of Isotope Exchange between Hydrogen and Liquid Ammonia on Heterogeneous Catalysts

R. HAUL and D. BLENNEMANN, *J. Catalysis*, 1962, **1**, (5), 432-442

Pt, Pd, Ni and Fe catalysts were used in the H/D exchange reaction at pressures up to 150 atm and temperatures between -60° and +25°C. The order of activity was found to be: Pt/C > Pd/

C > Raney-Ni > Raney-Fe. The influence on the exchange rate of catalyst concentration and surface area, of temperature, and of hydrogen pressure was studied. A mechanism involving isotope exchange between chemisorbed hydrogen atoms and a chemisorbed NH_3 molecule is supported by experimental results. The exchange was also studied in the gas phase on Pt/C and in the liquid phase with a homogeneous KNH_2 catalyst.

The Catalytic Oxidation of Ethylene in the Presence of Aqueous Solutions of Palladium Salts

K. I. MATVEEV, A. M. OSIPOV, V. F. ODYAKOV, YU. V. SUZDAL'NITSKAYA, I. F. BUKHTOYAROV and O. A. EMEL'YANOVA, *Kinetika i Kataliz*, 1962, 3, (5), 661-673

A study was made of the thermodynamics of the process: $\text{C}_2\text{H}_4 + \frac{1}{2}\text{O}_2 \rightarrow \text{CH}_3\text{CHO}$, in which the catalyst used is an aqueous $\text{PdCl}_2/\text{CuCl}_2$ solution, and of some of its stages. It was found that the reaction velocity depends on the partial pressures of C_2H_4 and oxygen, on pH, on the concentration of Pd, Cu and Cl ions in the original solution, on the temperature, and on complex formation. Optimum conditions for the process are proposed.

An Investigation of the Conversion of 2, 2, 4-Trimethylpentane and *n*-Octane over a Platinum Catalyst

YU. N. USOV and N. I. KUVSHINOVA, *Kinetika i Kataliz*, 1962, 3, (6), 931-936

Analyses of the products of the conversion reactions carried out over a 0.5% Pt/ Al_2O_3 catalyst in the presence of hydrogen are given in tables. Dehydrocyclisation and isomerisation reactions are shown to have occurred.

The Hydrogenolysis of Dicyclopentylmethane on Platinum Catalysts

J. NEWHAM and R. L. BURWELL, *J. Phys. Chem.*, 1962, 66, (8), 1431-1438

Hydrogenolysis was carried out in a flow reactor at 52°C using coprecipitated Pt/ Al_2O_3 , impregnated Pt/ Al_2O_3 , Pt/pumice and Pt/C catalysts. Reaction products, analysed by gas chromatography, were butylcyclopropane, isobutylcyclopropane, heptane, 2-methylhexane and 2, 4-dimethylpentane, in varying amounts. The degree of diffusional control was deduced from measurement of the composition of the bulk vapour phase. Results obtained in the presence and absence of large concentration gradients in the catalyst pores are shown. A model based on cylindrical pores is discussed.

Variations in the Activity of Solid Catalysts - Causes and Effects

G. FROMENT, *Ind. Chim. Belg.*, 1962, 27, (9), 1041-1049

The deactivation, poisoning and fouling of solid catalysts is discussed. Poisons which affect the

catalytic activity of Pt are classified. Particular attention is given to the effect of fouling of fixed-bed catalysts by carbonaceous deposits.

An Adsorption Flow Method for Specific Metal Surface Area Determination

H. L. GRUBER, *Anal. Chem.*, 1962, 34, (13), 1828-1831

A flow CO chemisorption method for the determination of metal dispersion is described. Application of the method to Pt/ Al_2O_3 reforming catalysts showed the decrease in metal surface area due to sintering.

Determination of the Number of Active Sites on Platinised Platinum Electrodes from the Hydrogen Diffusion Current

F. NAGY, GY. HORÁNYI and GY. VÉRTES, *Acta Chim. Acad. Sci. Hung.*, 1962, 34, (1), 35-49 (In English)

Platinised Ni electrodes were used in the construction of an analogue apparatus to determine the relationship between the rate of hydrogen diffusion and the number of active sites on a Pt electrode. The results were then applied to the case of a rotating disc electrode. An aged platinised Pt electrode was found to have, respectively, active site densities of 1.3×10^{10} and 0.6×10^{10} , 6 and 12 days after platinising.

Investigations on the Range of Activity of Active Hydrogen Prepared by Different Methods at Atmospheric Pressure

J. NEUGEBAUER, L. IMRE and T. MILLNER, *Acta Chim. Acad. Sci. Hung.*, 1962, 34, (4), 469-474 (In German)

Activated (atomic) hydrogen was produced on amalgamated Al from H_2O vapour, on β -W from moist hydrogen, and on Pd powder from molecular hydrogen. Powdered WO_3 or MoO_3 were used to test the range of activity of the activated hydrogen, which was found not to exceed the adsorption layer of the powder particles. The presence of H_2O molecules can extend the range to a distance of 60 μ from the catalyst.

Catalytic Hydrogenation and Hydrocracking of Carbonyl Compounds of Furans

N. I. SHUIKIN, I. F. BEL'SKII and G. K. VASSILEVSKAYA, *Z. Chem.*, 1962, 2, (12), 359-362

Pt/C, Pd/C, Ir/C, Rh/C, Ru/C and Os/C catalysts were used in the gas-phase hydrogenation of 2-alkyl-5-acylfurans at 200° and 300°C and 1 atm. With Pt/C, selective hydrocracking of the furan ring occurred at the ether bond adjacent to the carbonyl group. With the other catalysts, reduction of the carbonyl group predominated, and occurred exclusively with Os/C. The carbonyl group of 2-methyl-5-acylfuran was reduced on Co/Al, but hydrocracking of the furan ring occurred exclusively with Pd/Al. Both reactions occur equally on Ni/Al.

Aldehydic Materials by the Ozonisation of Vegetable Oils

E. H. PRYDE and J. C. COWAN, *J. Amer. Oil Chem. Soc.*, 1962, **39**, (11), 496-500

The production of various aldehyde esters and aldehyde oils by the complete or partial ozonisation of unsaturated vegetable oils, followed by the reductive decomposition of the ozonolysis products, is described. Yields in excess of 90% were attained, using CH_3OH as solvent. Reduction by Zn and CH_3COOH gave a minimum of by-products. Side reactions occurring during hydrogenation over a Pd/C catalyst were inhibited by the addition of $\text{C}_6\text{H}_5\text{N}$ to the solvent.

A Contribution to the Study of the Catalytic Oxidation of Propane on Platinum

S. CHAYBANI and M. PAGET, *Bull. Soc. chim. France*, 1962, (7), 1289-1294

Using a quartz reactor with a catalyst bed of Pt cylindrical pellets and conditions of dynamic flow, kinetics of the oxidation were studied at temperatures near 280°C under atmospheric pressure. The reaction is heterogeneous and results suggest competition at the catalyst surface between the reactants. The heats of adsorption of oxygen and C_3H_8 differ by about 5000 cal/mol. and the activation energy required is about 18,000 cal/mol.

Investigation of the Mechanism of the Catalytic Phase-Boundary Reaction of Hydrogen with Palladium, Tantalum and Titanium

A. KÜSSNER, *Z. Elektrochem.*, 1962, **66**, (8/9), 675-679

Experiments carried out with Pd, 30% Ag-Pd, Ta and Ti confirmed that atomic adsorption of hydrogen in molecular-sized cracks precedes its phase-boundary reaction with these metals. It is suggested that the cracks and grain boundaries are catalytic points for hydrogen-transfer. The transfer of hydrogen on Ag-Pd foils may be used to produce electrochemical energy. A water electrolysis cell with a Ag-Pd tube cathode, used for the production of pure hydrogen, is described.

A Mass Spectrometric Study of the Heterogeneous Combustion of Organic Vapours on Platinum. I. The Case of Methane with Excess Oxygen

H. G. LINTZ, A. PENTENERO and P. LE GOFF, *J. Chim. Phys.*, 1962, **59**, (9), 933-940

A Pt filament was used as the catalyst for the low-pressure combustion reaction. It was shown that a fraction of the oxygen adsorbed on the Pt was desorbed between 600° and 1300°K and that the combustion reaction was measurable in the same temperature range. Experimental results indicate that, in the presence of excess oxygen, the reaction is dependent on the CH_4 pressure and independent of the initial pressure of oxygen. The reaction rate

depends on temperature and the state of the catalyst surface.

Hydrogen-Deuterium Exchange in Monomolecular Chemisorption Layers of Ultra-High Vacuum Evaporated Platinum Films

H. GENTSCH, *Z. phys. Chem. (Frankfurt)*, 1962, **35**, (1-3), 69-85

The exchange reaction was studied in the temperature range 77° to 295°K and changes in the electrical resistance of the Pt film were followed simultaneously. Gas analysis was performed in the pressure range 10^{-10} to 10^{-8} Torr. The difference in the heats of chemisorption of hydrogen and deuterium was calculated. The exchange was too rapid to measure at temperatures above 178°K , and at 77°K and 90°K minor gaseous impurities reduced the reaction velocity. Changes in electrical resistance due to chemisorption of hydrogen and deuterium on Pt films were of equal magnitude.

An Interpretation of the Formation of trans-Cycloalkanes in the Partial Hydrogenation of Certain Cyclic Dienes

W. R. MOORE, *J. Amer. Chem. Soc.*, 1962, **84**, (19), 3788-3789

Observations during the hydrogenation of 1, 2-cyclononadiene and 1, 2-cyclodecadiene over 10% Pd/C and during the hydrogenation of *cis*, *cis*-1, 3-cyclodecadiene showed the formation of substantial amounts of *trans* olefins although the *cis* compound predominated in the final product. It is suggested that half-hydrogenated species exist on the catalyst long enough for the most stable configuration to be attained.

Effects of Platinum Area and Surface Acidity on Hydrocracking Activity

O. A. LARSON, D. S. MACIVER, H. H. TOBIN and R. A. FLINN, *Ind. Eng. Chem. (Process Design and Development)*, 1962, **1**, (4), 300-305

Abstract in *Platinum Metals Review*, 1962, **6**, (1) 36.

The Catalytic Oxidation of Ethylene on Palladium Films

C. KEMBALL and W. R. PATTERSON, *Proc. Roy. Soc., Series A*, 1962, **270**, (1341), 219-231

Products of the oxidation reaction carried out on evaporated Pd films, in the temperature range 50° to 140°C , were analysed by a mass spectrometer. Complete oxidation of C_2H_4 to CO_2 and H_2O was the main reaction, but a side reaction produced traces ($\approx 3\%$) of $(\text{CH}_3\text{CO})_2\text{O}$ and CH_3COOH . Kinetic studies determined the dependence of the reaction on C_2H_4 and oxygen pressures. The oxidation of CH_3CHO on a Pd film, studied separately at 77°C , produced $(\text{CH}_3\text{CO})_2\text{O}$ and CH_3COOH , which slowly poison the main reaction. Possible reaction mechanisms are discussed.

The Hydrocracking of Saturated Hydrocarbons over Evaporated Metal Films

J. R. ANDERSON and B. G. BAKER, *Proc. Roy. Soc., Series A*, 1963, **271**, (1346), 402-423

Reaction rates were measured for hydrocracking of lower saturated aliphatic hydrocarbons in the presence of excess hydrogen over Ni, W, Rh and Pt films, and product distributions were determined. The reaction mechanism for each metal is discussed. Experimental data suggest that hydrocarbon adsorption by the catalyst involves C-C bond rupture and the substitution of hydrocarbons for hydrogen at sites on the metal. Molecular rearrangements may occur on the catalyst, particularly on Pt. Catalyst and hydrocarbon reactivities were compared. In general, the catalytic activity sequence is $Rh > W > Ni > Pt$.

The Poisoning by Mercuric Chloride of Platinum-on-Cadmium Oxide Adsorption Catalysts in the Decomposition of Hydrogen Peroxide

ZH. V. STREL'NIKOVA, E. A. TROSMAN and V. P. LEBEDEV, *Zhur. Fiz. Khim.*, 1962, **36**, (11), 2469-2472

The poisoning effect of adding $HgCl_2$ to the catalyst was measured. It was shown that the adsorption capacity of the catalyst increased as the Pt content increased from 0 to 8%. The catalytic activity for each composition of Pt/CdO remained a constant, independent of the quantity of poison adsorbed.

Raw Materials for Man-Made Fibres

P. W. SHERWOOD, *Ind. Eng. Chem.*, 1963, **55**, (1), 37-42

A survey is made of thirty-one processes for the production of raw materials used in the manufacture of rayons and acetates, acrylic fibres, nylons and polyester fibres. Platinum metal catalysts are used in ten of the methods listed.

CHEMICAL TECHNOLOGY

Chemical Processors Use More Titanium

H. B. BOMBERGER, *Ind. Eng. Chem.*, 1963, **55**, (1), 53-56

In this review, the properties and applications of Ti and its alloys are discussed. Ti is used widely as a material of construction in chemical process industries because of its good workability, moderate strength, and excellent corrosion resistance. 0.2% Pd-Ti and Pd-Mo-Ti alloys are used in reducing acid conditions. Platinised-Ti and Pt-clad Ti are used for anode materials in perchlorate production, chlorine cells, cathodic protection, electroplating, metal refining and recovery, and in experimental fuel cells. V-Al-Ti alloys have many applications in the construction of rockets and missiles. (21 references)

GLASS TECHNOLOGY

Fundamentals of Glass-to-Metal Bonding. VIII. Nature of Wetting and Adherence

J. A. PASK and R. M. FULRATH, *J. Amer. Ceram. Soc.*, 1962, **45**, (12), 592-596

The relationship of interfacial energy to wetting and adherence is discussed. Experimental results obtained previously by measurement of contact angles between glass and Pt, Au, Fe and other metals are summarised. Measurements were made *in vacuo* and in oxygen, air and other atmospheres. A theory advanced for the mechanism of adherence of glass to metals shows that good adherence depends on the formation of a strong chemical bond. Interaction between molten $Na_2Si_2O_6$ glass and oxygen adsorbed on Pt, Au and Fe, and the resulting adherence, are discussed.

ELECTRICAL ENGINEERING

An Investigation on the Resistance of Sulphided Silver and Silver Alloy Contacts

A. HENTSCH, *Elektrie*, 1962, **16**, (7), 234-236

Measurements were made of the electrical resistance of Ag, 30% Pd-Ag, and 3% Cu-Ag contacts on exposure to H_2S over a period of 20 days. The current used and contact pressure ranged from 0.5 to 5000 mA and 20 to 20,000 mp, respectively. The Pd-Ag contacts showed greater resistance to sulphide formation than Ag contacts under the same conditions.

TEMPERATURE MEASUREMENT

Design and Operation of a Pressure-Type Cryostat for Thermometer Calibration in the Liquid-Hydrogen Region

G. CAMERON and R. L. BLANCHARD, *I. S. A. Trans.*, 1962, **1**, (3), 255-262

The calibration of Pt resistance thermometers in the range 14° to 27°K is described. The thermometers and a standard Pt resistance thermometer sealed in a steel probe are immersed in liquid hydrogen in the cryostat. Required temperatures are generated by controlling the vapour pressure over the liquid hydrogen, and the resistance of the thermometers is measured. The pressure control system and construction of the cryostat are described in detail. Total uncertainty is less than $\pm 0.04^\circ K$, $-0.03^\circ K$ at 14°K and $\pm 0.022^\circ K$, $-0.012^\circ K$ at 20°K and above.

Thermocouples for Measuring Temperatures of Liquid Cast Iron and Steel

J. NOWAK, *Prz. Odlew.*, 1962, **12**, (7), 206-211

The development of thermocouples for temperature measurement of the molten metals above

1200°C is described. The thermoelectric characteristics of Pt:10% Rh-Pt, W: Mo, W: graphite, and W:SiC thermocouples are discussed. For temperatures up to 1650°C, a Pt:10% Rh-Pt thermocouple is recommended.

The Continuous Thermo-electric Measurement of Temperature during Steel-making by Pneumatic Processes

W. A. FISCHER, *Stahl u. Eisen*, 1962, 82, (13), 797-808

Steel temperatures up to 1625°C were measured

continuously by sheathed 6% Rh-Pt: 30% Rh-Pt thermocouples inserted through the linings of an experimental 300 kg converter, a 15-ton Thomas converter, and an 18-ton "LD-AC" oxygen-blown converter. The accuracy of the readings obtained was confirmed by spot checks with immersion thermocouples. A Pt:10% Rh-Pt thermocouple similarly installed in a 40-ton converter with oxygen-enriched blast proved less reliable. Protection of the thermocouples by ceramic materials and the installation and changing of the measuring lances are described in detail.

NEW PATENTS

Fuel Cells

THE ELECTRIC STORAGE BATTERY CO. *British Patent* 910,495

An electrode for a fuel cell comprises a porous matrix of which at least the pore surfaces consist of an alloy of 1-47% nickel, 50-96% silver and balance palladium. Stated to give a high efficiency of conversion into electricity.

11 β -Methyl-5 α -Steroids

THE BRITISH DRUG HOUSES LTD. *British Patent* 912,038.

A platinum or palladium catalyst is used in the preparation of 11 β -methyl-5 α -steroids by reacting a solution in an inert solvent of the corresponding 11 β -methylene-5 α -steroid with hydrogen in the presence of the catalyst.

Anode for Electrolytic Production of Chlorine

FARBWERKE HOECHST A.G. *British Patent* 912,194

An anode for use in the production of chlorine by electrolysis of aqueous solutions of alkali metal chlorides or hydrochloric acid is formed of a base of niobium, or an alloy thereof, on which is a thin coating of one or more platinum group metals. Iridium or iridium-platinum are preferred.

Selective Hydrogenation Catalysts

THE DOW CHEMICAL CO. *British Patent* 912,444

A catalyst (suitable for the selective hydrogenation of acetylene and substituted acetylenes in the presence of di- and mono-olefins, acetylene and diolefins in the presence of mono-olefins, and diolefins in the presence of mono-olefins) is composed of a high surface area activated alumina on which is finely dispersed metallic copper activated by ruthenium, rhodium, palladium, iridium or platinum.

Catalyst Composition

AMERICAN CYANAMID CO. *British Patent* 913,449

A catalyst for oxidising hydrocarbon combustion

exhaust gases is composed of a major portion of alumina, 3-30% of vanadium pentoxide, 0.001-10% of a platinum group metal (platinum or palladium) and/or 0.1-10% of a catalytically active stable copper compound, e.g. copper oxide.

Production of Formaldehyde

HUTTENWERK OBERHAUSEN A. G. *British Patent* 913,581

In the production of formaldehyde by oxidising methane and/or homologous gaseous paraffin hydrocarbons with oxygen in the presence of a catalyst, the gaseous mixture is passed through a porous fixed bed of catalyst, e.g. pumice, and then through a metal mesh adjacent to the bed and formed of platinum or iridium or an alloy thereof, e.g. 95% platinum and 5% iridium.

Fuel Cell Electrodes

IMPERIAL CHEMICAL INDUSTRIES LTD. *British Patent* 913,592

A fuel cell has gas-permeable electrodes, one or more of which has a surface of titanium on which is deposited a platinum group metal.

Fabrication of Ruthenium

THE INTERNATIONAL NICKEL CO. (MOND) LTD. *British Patent* 913,876

Ruthenium is fabricated by compacting ruthenium powder having a surface area of 2-10 m²/g under a pressure so correlated with the surface area and the sintering temperature that, after sintering, the density is greater than 90% of the theoretical density of solid ruthenium.

Cyclopropylamines

ABBOTT LABORATORIES LTD. *British Patent* 913,898

N-benzylcyclopropylamine is prepared by hydrogenating N-benzylidenecyclopropylamine in a solvent at room temperature in the presence of a palladium catalyst.