ABSTRACTS
of current literature on the platinum metals and their alloys

PROPERTIES

Drastic Reduction of Adsorption of CO and H₂ on (111)-Type Pd Layers


Clean surfaces of (111)-type Pd layers, grown from the vapour phase on Mo(110) at room temperature were used to study the adsorption of CO and H₂ by various techniques. Mild annealing of the as-grown layers during a single desorption cycle (to ~600K) drastically reduces the adsorptions. Low-dose Ar⁺ bombardment restores high adsorption probability.

Photographic Properties of Palladium-Containing TiO₂ Layer under Nickel Physical Development


The photographic properties of Pd-containing TiO₂ layers under Ni development depend on the Pd concentration in the layer, TiO₂ preparation conditions and on the development conditions. Both negative and positive images can be obtained depending on the Pd²⁺ content.

A Study of the Palladium-Platinum-Hydrogen System over a Wide Range of Hydrogen Pressures


Measurements of changes in electrical resistivity in Pd-Pt alloys caused by absorption of H₂ at 30 kbar pressures, were made at 25–70°C. Substantial resistivity changes due to H₂ absorption occur over increasingly higher ranges of pressure with increasing Pt contents. There is a gradually accelerating increase of resistivity with increasing H₂ pressure up to maximum values, followed by a decrease back to close to initial H₂-free values. An extrapolation of results suggests it may be possible to attain a solid solution of H₂ in pure Pt up to a composition of ~PtH₂₅ at H₂ pressures of ~100 kbar at 25°C.

Properties and Electron Transfer Reactivity of Coordination Compounds for the Photochemical Splitting of Water

L. MOGGI, NTIS, Chemistry, 3 May 1983, 426

Photochemical, photophysical and electrochemical properties have been determined for the excited states of many polypyridine complexes of Rh(III), Ir(III), Ru(II), Os(II) and Cr(III) for use in cyclic photochemical systems for the splitting of water.

Blue Sputtered Iridium Oxide Films (Blue SIROF’s)


“Blue” sputtered Ir oxide films (blue SIROF) were prepared and compared with “black” SIROF’s and anodically grown Ir oxide films (AIROF). Blue SIROF’s are prepared by reactive d.c. sputtering of Ir in an Ar : O₂ 80 : 20 mixture, at deposition rates of ~200 Å/min on substrates held at 238K. Blue SIROF’s have similar physical properties to AIROF’s. In contrast to SIROF’s previously deposited in pure O₂ onto substrates held at 289K the new films have an optical absorption spectrum which peaks at 610nm. The blue SIROF’s have an improved open-circuit bleached state and memory.

Oxidation of Ruthenium


Ru has been heated in air at 100–400°C to find its usefulness as an electrical contact. At up to 200°C Ru oxidises to produce a film which causes high contact resistance. Above 300°C Ru forms an oxide film RuO₂ which has low contact resistance. The film <200°C is a lower Ru oxide (probably RuO).

Preparation, Electrical Resistivity and Its Temperature Dependence of RuO₂-Polystyrene Composite Powder


RuO₂-polystyrene composite powder was prepared by mixing fine powdered RuO₂ and PS beads thoroughly in ethanol. RuO₂-coated PS beads were also prepared by direct suspension polymerisation of styrene in an aqueous phase in the presence of suspended RuO₂ powder. The apparent d.c. volume resistivity, ρᵥ of the hot-pressed composite was measured from 20–80°C, pressure 3.5–35 MPa and volume fractions of RuO₂. ρᵥ increased linearly with temperature on a double logarithmic scale. The composite prepared by direct polymerisation completed a network of the conductive phase at a smaller fraction of RuO₂.

Ion Mixing to Produce Amorphous Mo-Ru Superconducting Films


Amorphous Mo₅Ru₃ alloy films were formed by ion mixing of multilayered samples. The ion mixed films, which contain no metalloid element, show excellent superconducting properties.
CHEMICAL COMPOUNDS

Chemistry of Triosmium Carbonyl Cluster Compounds and Its Implications for Catalysis
A study of a series of triosmium carbonyl cluster complexes formed by the addition of a variety of small heteronuclear unsaturated molecules to the cluster complex H$_2$Os$_3$(CO)$_6$(I) is presented. The reactions of (I) with isocyanides, nitriles, aryl isocyanates, carbodiimides, aryl isothiocyanates and CS$_2$ are described. The evidence suggests that cluster compounds have unique chemical properties allowing development as a new class of reaction catalysts.

ELECTROCHEMISTRY

Transient Behaviour in Electroreductions of Ethylene and Acetylene on Pt in H$_2$SO$_4$ Solution
Studies were made of transient behaviour in electroreductions of C$_2$H$_4$ and acetylene on a Pt electrode. Open circuit potential measurements under the contact of the electrode were performed at 0V with C$_2$H$_4$ and acetylene showed that from the three kinds of adsorbed H atoms on Pt the second stable one takes part in the reactions, while the most stable one is inactive.

Crystallographic Anisotropies in Electrochemical Etching of Pt
Single crystal microspheres of Pt are examined by SEM after electrochemical and chemical etching in chloride and cyanide solutions. In all cases, a single major crystal plane is formed which is not the close packed (111) plane. Electrochemical chloride etching with a.c. potentials produces large smooth planes near (100), and the (111) plane is attacked readily to form (100) facets.

Electroreduction of Acetone on Pt-Ni Catalysts
Studies of adsorption and catalytic properties of metallic Pt-Ni alloys were made during electroreduction of acetone in tN KOH at 23°C. Analysis of polarisation curves of the electroreduction on Pt, Ni and Pt-Ni alloys showed that alloys containing >60 at.% Pt have a form of curves similar to Pt and Ni, whereas alloys containing <50 at.% Pt have different forms of curves. It is concluded that ordered atoms in Pt-Ni system give higher catalytic activity. Alloys in equiatomic systems have 6 times higher activity than Pt in the studied reaction.

Anodic Characteristics of Amorphous Palladium-Iridium-Phosphorus Alloys in a Hot Concentrated Sodium Chloride Solution
The corrosion resistance and electrocatalytic activity for Cl$_2$ and O$_2$ evolutions at amorphous Pd-Ir-P alloys containing a small amount of Ti, Rh, Pt and/or Ru in hot concentrated NaCl solution were investigated. The electrocatalytic activity of several amorphous alloys for Cl$_2$ evolution was much higher than that of dimensionally stable RuO$_2$-Ti anodes, while their catalytic activity for O$_2$ evolution was lower than that of the RuO$_2$-Ti electrode, suggesting amorphous alloys can produce high purity Cl$_2$ at high efficiencies.

Interfacial Properties of Oxides Used as Anodes in the Electrochemical Technology
A review of surface chemistry of oxides and the behaviour of the relevant insoluble oxides is presented. The oxides are the components of electrodes used in chlor-alkali cells, water electrolysis, electroorganic oxidations, metal electrowinning and cathodic protection. Oxides discussed include RuO$_2$ and IrO$_2$. (492 Refs.)

Ruthenium Behaviour during Electrochemical Dissolution of Its Binary Alloys with Copper
Studies of Ru behaviour during electrochemical dissolution of Cu-Ru binary alloys containing 0.004% and 0.01–0.03% Ru were made in solutions of H$_2$SO$_4$ and CuSO$_4$ of various acidities by anodic polarisation measurements. Anodic polarisation curves rose in more electropositive areas with the increase of the Ru content in the alloy. An increase in acidity resulted in dissolution of Ru into the solution, and at 1.4V the dissolution of Ru in 4N H$_2$SO$_4$ + 1.5% CuSO$_4$ was nearly complete. The rate of dissolution of Ru in the electrolyte was found.

XPS Studies of Oxygen Evolution on Ru and RuO$_2$ Anodes
Anodic oxidation of Ru and RuO$_2$ electrodes in tN H$_2$SO$_4$ has been investigated using XPS. During O$_2$ evolution of Ru, a highly defective hydrate oxide film is formed as a result of corrosion. At 370°C in vacuum this film decomposes to metallic Ru. The surface of RuO$_2$-anodes prepared by thermal decomposition of RuCl$_3$ contains some RuO$_2$, which is stable during anodic polarisation.
PHOTOCONVERSION

Photo-Induced Hydrogen Evolution Accelerated at Semiconductor/Liquid Interface
T. SHIMIZU, T. IYODA, Y. KOIDE and N. KANDA, Nour.

A novel water photoreduction system is presented, where an appreciable quantity of H_2 is catalytically produced by visible light illumination in neutral aqueous solution containing an appropriate electron donor, platinised semiconductor powder and a water soluble Zn porphyrin. The ZnTTPS-ZnO/Pr-TEA system showed the highest catalytic activity. A platinised semiconductor powder plays the role of an excellent electron relay and redox catalyst for H_2O reduction.

Factors Influencing Product Distribution in Photocatalytic Decomposition of Aqueous Acetic Acid on Platinized TiO,
H. YONEYAMA, Y. TAKAO, H. TAMURA, Japan.

Reaction products of the photocatalytic decomposition of acetic acid/acetate mixtures at Pt/TiO_2 were examined. The relative yield of C_2H_4:CH_4 produced was high when the decomposition rate was high, and the amount of CO_2 produced usually exceeded that of the methyl radical consumed in the formation of CH_4 and C_2H_6 Ethanol and acetaldehyde were produced. The production occurred even under adverse conditions, and even when a very high acidic bias completely suppressed any cathodic reaction CH_4 was produced in higher yields than C_2H_6.

Photoassisted Water-Gas Shift Reaction over Pt/TiO_2 (100)

Saturated H_2 production was observed over platinised TiO_2 (100) in the presence of H_2O vapour and CO with or without u.v. illumination. The thermal reaction is dominant at temperatures over 400K. Below 400K the photoreaction is dominant, and is independent of H_2O and CO partial pressures in the range 0.5 to 18 Torr and 0.1 to 10 Torr, respectively. Reaction rate increases monotonically with increasing u.v. intensity.

Hydrogen Generation by Photocatalytic Oxidation of Gases by Platinized n-TiO_2 Powder

The photocatalytic reaction of glucose in aqueous solution containing platinised n-TiO_2 powder occurred at pH = 4.5. Under an inert atmosphere H_2 and CO_2 were produced, but under an O_2 atmosphere, only CO_2 was produced. For a 2.8M glucose solution and at 60°C, the initial H_2:CO_2 ratio was near 10, but decreased to near 3 at times >100 hours. Gas evolution rates were determined.

Semiconductor Electrodes.

Photooxidation of Halides and Water on n-Silicon Protected with Silicide Layers

The electrochemical and photoelectrochemical behaviour of n-type Si electrode coated with noble metal silicides and RuO_2 in aqueous solutions containing various redox couples was studied. Ir silicide coated n-Si electrodes, n-Si(Ir), and RuO_2-modified n-Si(Ir) electrodes can photogenerate I_2, Br, and Cl_2 with high stability and efficiencies (75%). The photo-oxidation of H_2O on these electrodes is also feasible.

ELECTRODEPOSITION AND SURFACE COATINGS

H. M. SMITH, Met. Fin., 1983, 81, (3), 55-58

Electrodeposits of Pt, Pd, Rh and Ru are reviewed. Properties, electroplating applications and an analysis of platinum group metals in industry are reviewed. Physical properties reviewed include internal stresses, reflectance, corrosion and solubility, wear resistance, contact and arc resistances, electrical resistivity, solderability and thermal expansion.

The Electrolytic Deposition of Pd-Ni-Coatings from an Ammoniacal Electrolyte
M. BUTZ, F. FRIEDRICH and CH. J. RAUB, Metalloberflache, 1983, 37, (3), 89-93

Factors connected with the electrolytic deposition of Pd-Ni coatings from an ammoniacal electrolyte are examined. These include the plating bath conditions, the composition of the deposit, temperature and pH, the H content in the deposit, internal voltages and deposit thicknesses. The use of a high deposition rate is also considered. The H content of the deposits is a strong indicator of the working conditions.

LABORATORY APPARATUS AND TECHNIQUE

Urea Sensor Based on Iridium Dioxide Electrodes with Immobilized Urease

An IrO_2 electrode with immobilised urease was found to be useful as a potentiometric detector for pH changes resulting from hydrolysis of urea at the electrode surface. Electrodes constructed by urease entrapment in a PVC film are superior to electrodes with urease covalently immobilised to the oxide layer via a cyanuric chloride linkage. Logarithmic response is obtained for the range 5 x 10^{-2} to 5 x 10^{-3}M urea, with a slope of -51 mV/decade. The slope is constant for ∼12 days. Recoating a stripped electrode with PVC-urease has essentially no effect on the slope.
Effects of Impurities on Hydrogen Permeability through Pd Alloy Membranes at Comparatively High Pressures and Temperatures


The Pd alloy membrane method was studied as a means for purifying fusion reactor fuel by investigating the effects of impurities on the permeation characteristics, at high pressures and temperatures, of Pd alloys. The H₂ permeability of Pd-2.5 wt.% (Ag-Au-Ru) was not affected by impurities such as NH₃, CH₄, CO, CO₂ and N₂ which are present at concentrations 10–10,000 ppm in H₂. However, permeability deteriorates on contamination with oil vapour, but is easily recovered.

A Proposed Method of Hydrogen Isotope Separation Using Pd Alloy Membranes


The viability of using Pd alloy membranes in cascade separators is discussed. Values of the permeation separation factor are estimated for Pd-20% Ag, and estimates for the number of stages and membrane area are given for the required isotope purification. Using Pd-8%Y will probably even further improve the performance.

HETEROGENEOUS CATALYSIS

Palladium-Catalyzed and Sonically Accelerated Hydrogenations of Olefins Using Formic Acid as a Hydrogen Transfer Agent


In the presence of Pd/C, formic acid is a very efficient H donor at room temperature. Ten olefins, including terminal and internal alkenes, a diene, a vinyl ether and an α, β-unsaturated ketone were hydrogenated in high yields at room temperature and atmospheric pressure. In the presence of sonic waves, the rate of hydrogenation was significantly increased.

Oxidation of Polyunsaturated Ethers and Esters with Molecular Oxygen Catalysed by Palladium Salts


Studies of oxidation of polyunsaturated ethers and esters with O₂ over PdCl₂-CuCl catalysts showed the formation of a series of new mono-, di- and triketosteroids. A synergetic effect in quaternary ammonium salts was observed during O₂ oxidation and was followed by an increase in the yield of carbonyl compounds.

On the Properties of Monodispersed Pd/MgO Catalysts


Microcalorimetric studies of adsorption of H₂ and O₂ on mono-(25–75 Å) and polydispersed Pd/MgO catalysts showed an increase in adsorption temperature of H₂ and O₂ with the decrease of Pd particle diameter. Selectivity and activity of Pd catalysts was found to depend on its dispersity and level of Pd reduction.

An Active Methanation Catalyst Prepared from an Amorphous Pd₃₅Zr₆₅ Alloy


A highly active methanation catalyst was prepared in situ from an amorphous Pd₃₅Zr₆₅ alloy. In the reaction at 260°C and 1 atm the catalytic activity had a 100-fold increase with time and after 60 hours had a steady value, compared to the initial value.

Palladium Alloys as Hydrogen Permeable Catalysts in Hydrogenation and Dehydrogenation Reactions


H₂ permeation across a binary Pd alloy catalyst (Pd alloyed with Al, Ti, Ni, Cu, Mo, Ru, Rh, Ag, In, W, Re, Pt) enhances the rate and selectivity of hydrogenation compared with what is observed when the compound being hydrogenated is mixed directly with H₂. The principal product of diene hydrogenation when the H₂ permeates through a membrane catalyst is not a saturated hydrocarbon but the corresponding olefin from which polymers can be synthesised.

Water Gas Shift Reaction Catalysed by Iridium Complexes Supported on Zeolites


Ir compounds, supported on 13-X faujasite type zeolite catalyse the water gas shift reaction. During the reaction carbonyl complexes are formed and are detected by i.r. spectroscopy. Addition of ethylene diamine enhances the catalytic activity.

Synthesis and Characterisation of an Alumina-Supported RuO₃ Cluster Catalyst


A [H₃RuO₃(CO)₆/Al₂O₃] was formed upon heating [RuO₃(CO)₆] adsorbed on γ-Al₂O₃ at 373–473 K under a H₂+CO atmosphere. The material is catalytically active for ethylene hydrogenation at 340 K and for but-1-ene isomerisation at 330 K.
Kinetics of the Fischer-Tropsch Synthesis
The kinetics of the Fischer-Tropsch synthesis reactions were studied in an internally recycled reactor over a 0.5% Ru/α-Al₂O₃ catalyst. Steady-state turnover numbers were obtained for 3:1 and 2:1 H₂:CO feed gas at 200–300°C. Intrinsic kinetic data were obtained on surface-impregnated catalysts. A mechanism for the Fischer-Tropsch synthesis was given and several kinetic models were developed. The product selectivity and CO conversion were strongly influenced by temperature.

Physical Effects on Fischer-Tropsch Synthesis over Composite Ru Catalysts
Fischer-Tropsch synthesis was studied over composite catalysts formed by addition of SiO₂ to Ru/Al₂O₃ and Ru/TiO₂. The results showed that the Ru catalysts produced significant changes in conversion and product selectivity.

Ruthenium-Based Catalyst for the Gas-Phase Synthesis of Alcohols from CO and H₂
Hydrogenation of CO with H₂ at 86kg/cm² and 255°C over a Ru, Mo and Na₂O catalyst gives a series of straight-chain primary alcohols as essentially the only liquid products. Since the liquid product was uncontaminated by hydrocarbons and other oxygenated products, the refining of the alcoholic products would be much simpler than with the conventional Fischer-Tropsch reaction.

Metal-Support Effects in the Catalytic Hydrogenation of CO over Ruthenium Y-Zeolites: Influence of Zeolite Basicity on Olefin Selectivity
The electronic interaction between small metal crystallites and basic or electron-donor sites in zeolite Y enhances the olefin selectivity of Ru in the hydrogenation of CO to hydrocarbons.

HOMOGENEOUS CATALYSIS
Pd(1) Complexes in Co-ordination Chemistry and Catalysis
A review is given of Pd(1) complexes in co-ordination chemistry including formation and physical properties of Pd(1) complexes, their methods of synthesis and reactions, and the role of Pd(1) compounds in stoichiometric and catalytic reactions. (163Refs.)

Study of Glycolic Ester Formation in Olefin Catalytic Liquid Phase Oxidation. VII. State of the Components in CH₃COOH-Dioxane-HNO₃-Pd(II) Contact Solutions
Studies were made of the state of components in contact solution CH₃COOH-dioxane-HNO₃-Pd(II) during oxidation of ethylene to saturated glycolic ester. Spectrophotometric studies showed that absorption of ethylene by contact solution at the beginning of the reaction resulted in formation of Pd nitrite complexes yielding saturated glycolic esters.

Mechanism of the Reaction of Oxidative Conjunction of Unsaturated Hydrocarbons in the Presence of Palladium (II) Complexes
L. V. KOZHEVNIKOV, Usp. Khim., 1983, 52, (2), 244–267
A review is given of data on the mechanism of liquid phase reaction of oxidative conjunction of arenes to diaryls, arenes with olefins to aryl-olefins and olefins to diene-1,3 in the presence of Pd(II) complexes. (161Refs.)

New Catalysts for Hydrosilylation of Acetylenic Compounds
The regio- and stereo-selectivity in the homogeneous hydrosilylation of acetylene and heptene-1 monosubstituents and carbofunctional ethylene derivatives in the presence of Pt and Pd catalysts of a new type [Pd(Ph₂P)₆Cl₄]_{10}, [Pd₂(Ph₂P)₆Cl₂]_{10}, [Pt(Ph₂P)₆Cl₄]_{10}, [Pt(Ph₂P)₆Cl₃]_{10}, [Pd(Ph₂P)₆Cl₄]_{10}, etc., have been studied. Unlike H₂PtCl₆ and other commonly used catalysts, their application for hydrosilylation of acetylenic compounds makes the process regio specific, forming the β-adduct.

Heat Activated Silicone Foam
The production and properties of a Rh catalysed flame resistant silicone foam are compared to those of a Pt catalysed one. RhCl₃(Bu₃S)₂ when used as catalyst produced a foam with a working time of at least 8 hours at room temperature and which foams rapidly upon heating at 100–150°C, – “heat activated foam”. Its flame retardancy is comparable to that of Pt catalysed foams. The “heat activated foam” cures slowly at room temperature to give an elastomeric material after a few days. Foaming at higher temperature and higher catalyst concentration gives a lower density foam. The heat activated foam has a honeycomb-like structure which makes it useful as window coating for a solar heating panel.
Two New Routes to Ethylene Glycol from Synthesis Gas


Industrial processes for ethylene glycol production using platinum group metal complex catalysts are described. One method, based on the catalytic hydroformylation of formaldehyde to glycolaldehyde and subsequent hydrogenation to ethylene glycol, uses stable Rh catalyst HRh(CO)\(_2\)\([\text{P}(	ext{C}_{21}H_{11})_3]_2\) in the presence of excess phosphine ligands.

Clay Intercalation Catalysts Interlayered with Rhodium Phosphine Complexes. Surface Effects on the Hydrogenation and Isomerization of 1-Hexene


Clay intercalation catalysts formed by interlayering of Na\(^+\)-hectorite with Rh phosphine complexes of the type Rh(NBD)\(_2\)\(\text{P}(\text{Ph})_3\) and Rh(NBD)(dppe)\(^+\), where NBD = norbornadiene and dppe = 1,2-bis(diphenylphosphino)ethane, were examined as catalyst precursors for the hydrogenation-isomerisation of 1-hexene in methanol. The intercalated catalysts have a much lower tendency to isomerise the substrate to the less reactive internal olefin 2-hexene under homogeneous conditions. The results showed that surface chemical effects can dramatically alter the catalytic properties of metal complexes immobilised in clay interlayers.

Alkane C-H Bond Activation: New Hope for Catalysis Research


The history and recent advances in alkane C-H bond activation are examined. Catalysts discussed include the diacetone Ir complex with two hydride and two triphenylphosphine ligands used by Bergman. Bergman has also found that there is a preferential attack on primary C-H bonds. Graham's work using an Ir catalyst, a new hydridoneopentyliridium compound, is discussed. Work on [C\(_4\)H\(_7\)C\(_{2}\)H\(_2\)]\(\text{IrH}[\text{CH}_{2}]_2\text{JH}_2\), which selectively activates alkane C-H bonds is examined. Work on heterogeneous catalysis and on arene C-H bond activation with Rh complexes is also considered.

An Osmium Catalyst for the Selective Electrochemical Oxidation of Alcohols


Addition of alcohols to bis(pyridine) \([\text{N}, \text{N}-\text{bis}(3,5\text{-dichloro-2-hydroxybenzamido})\text{C}_2\text{H}_4\text{ethane}][\text{Os}](\text{IV})\), \((\text{I})\), in CH\(_2\)Cl was studied. Controlled oxidation of \((\text{I})\) in the presence of alcohols forms a new Os species which shows catalytic activity for alcohol oxidation. Controlled potential oxidation of 0.5M benzyl alcohol in the presence of 40\% catalyst produced >40 catalyst turnovers with the selective production of benzaldehyde.

The OsO\(_4\)-Catalysed Decomposition of Hydrogen Peroxide


The rate of H\(_2\)O\(_2\) decomposition in the presence of OsO\(_4\) as catalyst was proportional to the first power of the OsO\(_4\) concentration, and to the power 1-1.2 of the H\(_2\)O\(_2\) concentration. Hydroxyl and superoxide radicals were formed during the decomposition.

Standardised Tethering of Ru\(_4\)-Ru\(_6\) Clusters to High Surface Area Oxides


Molecularly-specific routes to support Ru clusters have been developed to find the particle size effects on the catalystic activity of materials. Complexes Ru\(_4\)(CO)\(_3\)\(\text{L}\), Ru\(_6\)(CO)\(_3\)\(\text{L}\), Ru\(_4\)(CO)\(_3\)\(\text{L}\), Ru\(_6\)(CO)\(_3\)\(\text{L}\) [L = Ph\(_2\)P(\text{CH})\(_3\)CH\(_2\)Si(\text{OEt})\(_3\)] have been isolated and used to tether Ru\(_{3+}\) units to SiO\(_2\), Al\(_2\)O\(_3\), and TiO\(_2\) supports in a standard manner.

Ethanol from H\(_2\) and CO via Homogeneous Ruthenium Catalysis


Ru carbonyl complexes, obtained from Ru\(_4\)(CO)\(_3\) in the presence of an iodide promoter, an acid and a phosphate oxide, provide an unusually selective system for the direct conversion of CO and H\(_2\) to ethanol. Reaction conditions were 30 to 87 MPa and 180 to 250°C. Other products include methanol, methane, acetaldehyde, ethylene glycol and n-propanol.

FUEL CELLS

Composite Catalysts for Carbon Monoxide Resistant Fuel Cell Anodes


A comparison is made between a standard Pt-fuel cell anode and a 50/50 wt.% Pt-Ru alloy electrode, and a WC anode and a WC electrode with 0.1 wt.% Pt-Ru alloy electrode, and a WC anode and a WC electrode with 0.1 wt.% Pt. The electrolyte was phosphoric acid and the reactants were pure H\(_2\), and a 3% CO-H\(_2\) mixture. A modest gain in activity occurred for the 0.1% Pt/WC electrode and a sizeable gain for the 1% Pt/WC sample when H\(_2\) was the reactant. With CO present the 1% sample lost 96% of its activity, while the 0.1% sample decrease by 26%. A Pt/WC electrode can be made where the WC supports the anode reaction at low temperatures, with the Pt becoming active as temperature and the reaction rate increase. Anode polarisation curves for Pt and Pt-Ru, in the presence of CO, show the advantage of using Pt-Ru especially below 160°C. Pt-Ru and Pt/WC may be alternative anode electrocatalysts for fuel cells, started from low temperatures on reformate fuel.
CATHODIC PROTECTION

Hydrogen Absorption and Embrittlement of Tantalum by Cathodic Loading
The takeup and embrittlement of Ta by electrolytically produced H₂ was investigated on various samples. The oxide surface layers affect the H₂ uptake. Surface coatings of varying thicknesses with platinum group metals as alloying constituents were tested as anodic protection for Ta.

ELECTRICAL AND ELECTRONIC ENGINEERING

Precious Metal Inlays for P.C. Connector Contacts
D. MADDICK, New Electron., 1983, 16 (2), 44, 46, 49
An evaluation of noble metal alloy inlays as replacements for Au electrodeposits is presented. Solderability, high temperature mechanical endurance, effects of rapid change of temperature, mechanical endurance, solvent resistance and costs were examined. Alloys considered were 6Pt-25Ag-69Au, 40Ag-60Pd and 6Ni-94Au of thicknesses 0.5 μm and 0.75 μm.

NEW PATENTS

Oxygen Generating Electrode
JAPAN CARLIT CO. LTD. U.S. Patent 4,353,790
An O₂ generating electrode, for use in electrowinning, electrodeposition and electrolysis cells, has improved durability when it is formed from Ti or a Ti substrate coated with a first layer of metallic Bi or Bi oxide and a top layer containing IrO₂ and 5–50 mole % metallic Ir, preferably applied via an Ir halide solution.

Energy Efficient Electrolyser for Hydrogen Production
WESTINGHOUSE ELECTRIC CORP. U.S. Patent 4,357,224
A high surface area anode for use in an electrolyser for H₂ production has packed porous C pellets, preferably containing 1–5% Pt, pressed tight against an inert current collector which assists easy access of bisulphite ions to the anode. The conducting plate of the electrode may be of Pt, Au or TiO₂-coated Ti.

METALS AND ALLOYS

Electrical Contact Material
DEGUSSA A.G. European Appl. 74,507
A lower priced material for contacts, especially low current contacts, consists of a noble metal (preferably Au, Ag and/or Pt) and 1–50% of a glass frit (softening range more than 100%, at 400–750°C).

Electric Contact Alloy
W.C. HERAEUS G.m.b.b.H. German Offen. 3,121,069
An improved dispersion-hardened contact material is an Ag alloy containing 10–30% Pd and 0.03–0.2% Mg as Mg oxide and 0.03–0.2% Ni, 0.1–0.5% Ce as Ce oxide or 0.1–0.5% Mn as Mn oxide.

ELECTROCHEMISTRY

Brine Electrolysis Cathode
DIAMOND SHAMROCK CORP. U.S. Patent 4,350,608
A power-efficient electrode, for use in a brine cell, is obtained by coating a substrate formed by compressing a prefused mixture of C black with PTFE with an electrocatalytic coating. A preferred coating contains chloroplatinic acid which may be reduced to Pt.