ABSTRACTS
of current literature on the platinum metals and their alloys

PROPERTIES

Synthesis of Nanoscale Platinum Colloids by Microwave Dielectric Heating
Polymer-stabilised Pt colloids (diameter 2 to 4 nm) with nearly uniform spherical shape were prepared by microwave dielectric heating of poly(N-vinyl-2-pyrrolidone)/H₂PtCl₆/NaOH/H₂O/ethylene glycol. Different sizes of Pt colloids can be obtained by changing the molar ratio of PVP/Pt. However, the particle dispersity remains the same, ~0.17, regardless of the molar ratios of PVP/Pt and NaOH/Pt.

Enhanced Perpendicular Magnetic Anisotropy in Chemically Long-Range Ordered (0001) Co₆Pt₄₋ₓ Films
Chemical long-range ordering along the growth direction has been observed in mostly h.c.p. Co₆Pt₄₋ₓ films grown on a Ru(0 0 0 1) buffer by molecular beam epitaxy (MBE). This ordering enhances perpendicular magnetic anisotropy in h.c.p. films. A Pt segregation effect at the advancing surface, caused by dominant surface diffusion, promotes this uniaxial long-range ordering during the MBE process.

Effects of Annealing on the Magnetic Properties and Structures of Sputtered Co/Pt Alloy Thin Films
The short-time annealing (< 6 h) of sputtered Co/Pt films with 0–50 at.% Pt was investigated. The coercivity of a Co₆Pt₄₋ₓ film drastically increases by annealing at > 800 K, corresponding to an L1₁ ordered phase, formed by annealing at 940 K in < 1 h. The grain size greatly increases in the early stage of annealing. The grain size should be decreased in order to use the Co/Pt films as high density recording material.

Oxidation of Ordered Sn/Pt(111) Surface Alloys and Thermal Stability of the Oxides Formed
Two Pt-Sn surface alloys were oxidised at 300 K by O₂ exposure in UHV. Despite the (2 × 2) and √3 Sn/Pt surface alloys being less reactive than Pt(111), oxidation was possible under UHV conditions using O₂. O₂ adatoms are chemisorbed on Pt sites at large O coverage, giving PtOₓ, at highest coverage. The proximity of Pt resulting from Pt-Sn oxidation lowers the thermal decomposition temperature of SnO₂.

Nucleation and Growth Kinetics of Pd and CuPd Particles on NaCl(100)
The nucleation and growth kinetics of Pd and CuPd nanometric particles grown by condensation on UHV-cleaved NaCl(100) surfaces were studied. The nucleation of the CuPd particles is mainly controlled by the Pd adatoms. It is possible to obtain a homogeneous collection of bimetallic CuPd particles by condensing the two metals simultaneously. These uniform CuPd particles are suitable for use as supported model catalysts.

Structural Chemistry, Magnetism and Thermodynamic Properties of R,Pd₃In
Magnetisation, resistivity and specific heats of ternary intermetallics, R,Pd₃In, synthesised with the nominal composition RₓPd₃Inₓ (R = rare earth elements including Y) were studied. Magnetic and thermodynamic measurements revealed antiferromagnetic order below 32 K for this series except for Y, La, Yb and Lu. A wide homogeneity range was found for Ce,Pd₃Inₓ, where ferro- or antiferromagnetic order or both occur with features typical of a Kondo lattice. Intermediate valence behaviour but no magnetic ordering were exhibited by Yb,Pd₃Inₓ (≥ 0.3 K).

The First Coordinatively Saturated, Quadruply Stranded Helicate and Its Encapsulation of a Hexafluorophosphate Anion
The self-assembly of four molecules of 1,4-bis(3-pyridyloxy)benzene and two Pd(II) ions allowed the encapsulation of a PF₆⁻ ion within a quadruply stranded helicate. It is reported as not only the first example of a co-ordinatively saturated quadruply helicate, but also the first example of the encapsulation of a complex anion by a helicate.

Superconductivity of MRhSi (M = Ti, Zr and Hf) Prepared at High Pressure
Ternary Rh silicides TiRhSi(1), ZrRhSi(2) and HfRhSi(3) and alloys ZrRh₃, Ru₃Si (x = 0.1, 0.3, 0.5) were prepared by reacting stoichiometric amounts of each metal and Si powders at ~ 4 GPa and > 1200°C in a wedge-type cubic-anvil high pressure apparatus. Superconducting transition temperatures in (1), (2) and (3) are 5.1, 10.3 and 3.3 K, respectively. These ternary Rh silicides are new superconductors.
Thermodynamic Characterization of Hydrogen Interaction with Iridium Polyhydride Complexes


Studies of $H_2$ interaction with IrXH$_2$(PPr'$_3$)$_2$ (X = Cl, I) showed that $H_2$ reacts rapidly and reversibly with IrClH$_2$(PPr'$_3$)$_2$, forming IrClH$_2$(PPr'$_3$)$_2$H$_2$, at < 323 K. Equilibrium isotherms were used to obtain the relative partial molar enthalpy and entropy. The decrease in entropy with increasing $H_2$ concentration and the absence of plateaux in the equilibrium isotherms were consistent with a single phase solid solution having two chemical components. Due to stronger $H_2$ bonding at temperatures up to 350 K, $H_2$ could not be removed from the isoel complex.

Thermal Decomposition of [M$_3$(CO)$_{12}$] (M = Ru, Os) Physisorbed onto Porous Vycor Glass: a Route to a Glass/RuO$_2$ Nanocomposite


Glass/RuO$_2$ nanocomposites (average particle size 45 Å) were obtained by the impregnation and thermal decomposition of [M$_3$(CO)$_{12}$] (M = Ru, Os) carbonyl clusters inside the pores of porous Vycor glass. Thermal decomposition occurs via [HM$_2$(CO)$_{10}$(OSi-)] and [M(CO)$_3$(OSi-)] (n = 2, 3) intermediates which are formed at low temperatures.

Oxygen Vacancy Control in the Defect Bi$_2$Ru$_4$O$_7$: Pyrochlore: a Way to Tune the Electronic Bandwidth


Bi$_2$Ru$_4$O$_7$ pyrochlore (1) can be prepared with significant $\gamma$ oxygen vacancies by annealing Bi$_2$O$_3$ and RuO$_2$ at 1000°C, first in air and then under an inert atmosphere. At 4–290 K, (1) has a cubic structure and is metallic showing increased resistivity by one order of magnitude at 300 K, with respect to stoichiometric Bi$_2$Ru$_4$O$_7$. The control of the oxygen concentration in (1) is suggested as a clean way to tune the bandwidth of this material.

CHEMICAL COMPOUNDS

Synthesis, Electrochemistry, and Spectroscopy of Blue Platinum(II) Polyynes and Diynes


Soluble donor-acceptor polymers in which an $n$-butylphosphane-substituted Pt(II) acetylene group acts as donor, and a thieno[3,4-b]pyrazine as acceptor, were synthesised in order to obtain a system with a band gap < 2 eV. A blue rigid-rod polymer, prepared by the reaction of $trans$-[PtCl$_2$(PnBu$_2$)$_2$] with 2,3-ethynyl-5,7-thieno[3,4-b]pyrazine, exhibited the smallest band gap observed so far (1.77 eV) for an organometallic polymer.

Behaviour of the One-Dimensional, Inorganic Polymer $\text{[M}_{4}\text{P}S_{4}\text{]}^{-}$ Anions (M = Ni, Pd) in Organic Solutions


The behaviour of the salts KMPS, (M = Ni, Pd) and some solid-solution phases, KNi,Pd, Ps$_n$, when dissolved in DMF, was to form chains. For chains of $\text{[M}_{4}\text{P}S_{4}\text{]}^{-}$, the chain remains intact when heated up to 323 K, whereas the Ni derivative either fragments and/or rearranges into monomers, etc. This difference is accounted for in terms of M-S bond strengths.

PHOTOCONVERSION

Theoretical Study of CH$_2$, Photodissociation on Pd and Ni(111) Surfaces


Photofragmentations of CH$_2$ adsorbed on Pd and Ni(111) surfaces were studied by density functional theory and $ab$ initio molecular orbital calculations. These metal surfaces were represented approximately by finite metal clusters $M_n$ ($n = 1, 7, 10$). The CH$_2$–3$\delta$ Rydberg excited state was found to be stabilised by $\approx 2.0$ and $1.5$ eV through physisorption on the Pd and Ni metal surfaces, respectively, by electron transfer.

Photocatalytic of Os(dmpe)$_2$H$_2$: Matrix, Transient Solution, and NMR Studies of 16-Electron Os(dmpe)$_2$ (dmpe = Me$_2$PCH$_2$CH$_2$PMe$_2$)


Os(dmpe)$_2$H$_2$, synthesised by the reaction of $trans$-Os(dmpe)$_2$Cl, with Na under H$_2$, was found to consist of cis and $trans$ isomers ($\approx 60:1$). UV irradiation of Os(dmpe)$_2$H$_2$ in Ar and CH$_2$ yielded Os(dmpe)$_2$, with a characteristic multiband UV-vis spectrum. In CO-doped matrices, Os(dmpe)$_2$CO was generated. Laser flash photolysis (266 nm excitation) of Os(dmpe)$_2$H$_2$ in cyclohexane gave the same species.

Dipyridophenazine Complexes of Os(II) as Red-Emitting DNA Probes: Synthesis, Characterization, and Photophysical Properties


By incorporating modifications in the ligand sphere of several dipyridophenazine(dpzp) complexes of Os(II), the fundamental excited-state properties of these complexes could be characterised. With two ancillary ligands derived from bipyridine or phenanthroline, the Os(II) complexes exhibit emission maxima at $\approx 740$ nm and average excited-state lifetimes in the 10 ns range upon binding to DNA by preferential intercalation of the dpzp ligand. The utility of dpzp complexes of Os(II) as luminescent probes for DNA is illustrated.
The scanning microscope for semiconductor characterization (SMSC): Electrolyte photoreflectance and photovoltage imaging study of the electrochemical activation of RuS2 photoelectrodes for oxygen evolution


The photoelectrochemical behaviour of the O2 evolution from the Ru(bipy)32+ interface was examined. Electrolyte photoreflectance and photovoltage digital images were obtained as a function of surface pretreatment and show that polishing gives a scarcely photoactive surface, while electrochemical etching gives a high photoactive surface. Direct evidence of the influence of doping on the electric field distribution of the liquid junction is obtained.

Substrates for rapid delivery of electrons and holes to buried active sites in proteins


New reduced and oxidised states of cytochrome P450 were generated by electron transfer to and from the heme group of the buried active site. This was achieved by linking [Ru(bipy)3]2+ through a hydrocarbon chain to a species with high affinity for the heme cavity, such as imidazole or adamantane.

ELECTRODEPOSITION AND SURFACE COATINGS

Preparation of a Palladium Alloy Composite Membrane Supported in a Porous Stainless Steel by Vacuum Electrodeposition


Pinhole-free and ultrathin (< 1 μm) 78% Pd-22% Ni composite alloy membranes were deposited on porous stainless steel (SUS) by vacuum electrodeposition. This technique was subject to interference by H2O. Adsorption on the coating than alkenes and alkanes.

APPARATUS AND TECHNIQUE

New sol-gel oxygen sensor based on luminescence cyclometallated platinum complexes


Platinum(M) [MeOPhC6H4NH3])2Pd(N3) + X2(-) where MeOPhC6H4NH3 + X2(-) = NH3(CH2)3Si(OCH3)2 and Pt(IV) [MeOPhC6H4NH3]2Pd(N3) + X2(-) = 58% luminous intensity is quenched in ~ 10 s when switching from N2 to O2.

In situ characterization of ultra-thin palladium deposits on α- and γ-alumina


Ultra-thin Pd films deposited at 300 and 600 K onto α- and γ-Al2O3 surfaces by SSIMS, were characterised. Early stages of growth were investigated by analysing the ion intensity ratios, Pd+2/Pd+ and PdAO−/AlO−, to discriminate between three deposition stages in the submonolayer Pd films. The ion yield was found to be closely related to the Pd-Al2O3 bonding, which determines the morphology and the electronic structure of the system. On γ-Al2O3, Pd deposition gives weak Pd-Al bonding with nucleation of small 3D clusters. On γ-Al2O3, monolayers or flat islands grow, with the formation of Pd-Al and Pd-O bonds.

Determination of sulfite in sugar and sulfur dioxide in air by chemiluminescence using the Ru(bipy)32+-KBrO4 system


Sulfite has been determined by a chemiluminescence (CL) method using the Ru(bipy)32+-SO24--KBrO4 system (bipy = 2,2'-bipyridyl). The concentration of sulfate was found to be proportional to the CL intensity in the range 2.5 × 10-6 to 9.5 × 10-6 mol·l-1 sulfate solution. The detection limit is 3.8 × 10-6 mol·l-1 and the relative standard deviation for 5 × 10-5 mol·l-1 sulfate solution is 4.6%. The method was successfully applied to the determination of sulfate in sugar and SO24- in air by using triethanolamine as the absorbent material.

Luminescence quenching of Ru(II) complexes in polydimethylsiloxane sensors for oxygen


The luminescence quenching of tris(1,10-phenanthroline)Ru(II) and tris(4,7-diphenyl-1,10-phenanthroline)Ru(II) by O2 in polydimethylsiloxane films was investigated by steady state and time-resolved methods. An algorithm for behaviour, with one oxygen-dependent parameter, was deduced. The correlation of this parameter with oxygen partial pressure is identical for both dyes, and shows saturation behaviour.

Application of piezoelectric Ru(III)/cryptand-coated quartz crystal gas chromatographic detector for olefins


A Ru(III)/cryptand-coated piezoelectric quartz crystal sensor linked to a computer interface was prepared and used as a gas chromatographic detector for olefins. The oscillating frequency of the quartz crystal decreases on adsorption of organic molecules on the Ru(III)/cryptand coating. Alkynes show greater adsorption on the coating than alkenes and alkanes. The technique was subject to interference by H2O.
HETEROGENEOUS CATALYSIS

Effect of Inert Sites on the Kinetic Oscillations in the Catalytic CO Oxidation on Pt(100)
The effect of inert sites in the global oscillations in the oxidation of CO on Pt(100) for both random and clustered inert sites has been simulated by the cellular automaton technique. The structural phase transformation of the Pt substrate, the reaction kinetics of the adsorbed phase and diffusion of absorbed species were accounted for by cellular automaton rules.

Characterization and Properties of Pt/ZrO2-CeO2 Catalyst for Purification of Automotive Exhaust
The effect of the additive, ZrO2, in CeO2 on the properties of the Pt/ZrO2-CeO2 three-way catalyst was investigated. The results show that the support ZrO2-CeO2 has higher oxygen storage capacity (OSC) than CeO2 and that Pt/ZrO2-CeO2 catalyst has higher OSC than Pt/CeO2. The Pt/ZrO2-CeO2 catalyst is reduced at < 300°C. The second desorption of CO on Pt/ZrO2-CeO2 is at 570°C and that on Pt/CeO2 is at 620°C. Thus Pt/ZrO2-CeO2 shows higher activity than Pt/CeO2 for three-way catalytic reactions.

Behavior of Non-Promoted and Ceria-Promoted Pt/Rh and Pd/Rh Three-Way Catalysts under Steady State and Dynamic Operation of Hybrid Vehicles
Honeycomb-type Pd and standard Pt catalysts for exhaust after treatment in hybrid drive systems were investigated on non-promoted and CeO2-promoted Pd/Rh and Pt/Rh catalysts. The catalysts were tested by light-off experiments with steady and cycling feed stoichiometries, and pulsed-flow operation. Very different catalyst behaviours for NOx, CO and HC conversions, depending on operation mode, were found.

Oxidation of Methane over Pd/Mixed Oxides for Catalytic Combustion
Pd catalysts supported on mixed oxides, Pd/Al2O3-MO (M = Co, Cr, Cu, Fe, Mn or Ni), were studied for the low temperature catalytic combustion of CH4. Pd/Al2O3-36NiO showed excellent activity, despite its lower surface area, due to the small particle size of Pd. TPD showed that at low temperatures, the catalytic activity is dependent upon the adsorption state of O on Pd. Activity is enhanced by increasing amounts of adsorbed O2. XRD showed that the PdO phase is thermally stabilised on Pd/Al2O3-36NiO. The stability of the PdO species at higher temperatures may directly correspond to the increased catalytic activity.

Ad sorption Equilibrium and Catalytic Reaction of CFC-115 on Pd/Activated Carbon Powder
Adsorption equilibria of chloropentafluoroethane (CF, CF=CF, CFC-115) on Pd/activated C powder and on activated C powder at 298.15–373.15 K were well represented by the BET equation. The isosteric heats of adsorption of the CFC-115 on both adsorbents were of approximately the same order of magnitude as the heats of condensation, and were mainly due to physical forces. CFC-115 can be converted to pentafluoroethane (CF, CF=H, HFC-125) with > 99% selectivity by hydrodechlorination over Pd/activated C. The Pd/activated C powder was an effective adsorbent with potential to recover CFC-115 and act as a catalyst to manufacture HFC-125 from CFC-115.

Catalytic Oxidation of Volatile Organic Compounds I. Oxidation of Xylene over a 0.2 wt% Pd/HFAU(17) Catalyst
The transformation of o-xylene in low concentration (1700 ppmv) in air over 0.2 wt% Pd/HFAU(17) zeolite catalyst, with Si:Al ratio of 17, was investigated in a flow reactor at 150–320°C. At short time-on-stream, whatever the temperature, no xylene appears at the reactor outlet. The xylene oxidation into CO, C2H4 and H2O is accompanied by the retention of various products of xylene transformation, "coke", dependent on temperature, within the zeolite pores.

Alloying in Cu/Pd Nanoparticle Catalysts
The preparation of binary alloy nanoparticle catalysts on various supports was shown to be a new application for the atomic layer epitaxy technique. Cu/Pd bimetallic catalysts were prepared on SiO2 and on γ-Al2O3. EXAFS measurements showed that alloying occurred in the Cu/Pd samples with a Cu-rich surface for the Al2O3-supported sample and random alloying for the SiO2-supported sample. Particle sizes were in the range 20–60 Å.

Glucose Hydrogenation on Ruthenium Catalysts in a Trickle-Bed Reactor
Ru catalysts, prepared in a highly dispersed state by cationic exchange or anionic adsorption on active charcoal pellets, were shown to be very active for glucose hydrogenation (initial specific activity = 1.1 mol h–1 g–1 Ru at 100°C). The activities of the catalysts were very stable over several weeks and no leaching of Ru occurred. The selectivity to sorbitol was > 99.2% at 100% conversion. The study showed the negative effect of high residence time, which favours epimerisation of sorbitol to mannitol, but can be minimised if the residence time is that of 100% conversion.
Highly Efficient Oxidation of Alcohols and Aromatic Compounds Catalysed by the Ru-Co-Al Hydrotalcite in the Presence of Molecular Oxygen


A Ru hydrotalcite (HT) with Co cations, Ru-Co-Al-CO, HT, was found to be an effective heterogeneous catalyst for the oxidation of various alcohols in the presence of O₂. The HT catalyst was easily separated from the reaction mixture and was reusable without an appreciable loss of activity and selectivity. This heterogeneous oxidation is environmentally friendly because of the use of O₂, the simple work-up procedure and the reusable HT catalyst.

Hydrogenation of the Carbonyl Group in α-Ketoesters and α-Ketoamides Catalysed by Ruthenium Clay


Ru-phosphine-clay was prepared by a three-step process: reaction of a montmorillonite with (3-chloropropyl)trimethoxysilane, then treatment with KPPPh₃, and finally reaction with RuCl₃·H₂O. The Ru clay is an excellent catalytic system for the reduction of the α-carbonyl group of α-ketoesters and α-ketoamides (50-89% yield). The catalyst is stable and retains high efficiency during consecutive catalytic cycles.

HOMOGENEOUS CATALYSIS

Tailoring Aqueous Solvents for Organic Reactions: Heck Coupling Reactions in High Temperature Water


High temperature water (HTW) (pressurised aqueous reactions at >100°C) has been found to be an effective solvent for Heck coupling reactions of aromatic halides with cyclic amines in the presence of Pd(OAc)₂ catalyst. The dielectric constant of H₂O drops to ~6 at 373°C and 221 bar. No addition of co-solvents or specialised ligands was needed. Reactions in the presence of LiCl and quaternary ammonium salts indicated that the reaction takes place in the aqueous phase. The unusual properties of HTW provide a novel method for extending Heck coupling reactions into neat H₂O.

Selective Alk oxy carbonylation of 2,3-Dichloropyridines

Y. BESSARD and J. P. RODUT, Tetrahedron, 1999, 55, (2), 393–404

2,3-Dichloropyridines were shown to undergo monoor dicarbonylation in the presence of CO, an alcohol, and a Pd catalyst to give selectively either alkyl 3-chloropicolinates or dialkyl pyridine-2,3-dicarboxylates in good yields, depending on the reaction conditions. These compounds are of interest as herbicide precursors or as intermediates for antifibrotics.

Heck Reaction Catalyzed by Phosphapalladacycles in Non-Aqueous Ionic Liquids


Phosphapalladacycles are very efficient catalysts for the Heck reaction. The use of non-aqueous ionic liquids, such as tetra-n-butylammonium bromide or 1-methyl-3-propylimidazolium bromide, etc., with this catalyst system was found to be an effective alternative to traditional molecular solvents, such as acetonitrile or DMF. Easy product separation, possible catalyst recycling, and further increases in catalyst productivity were all shown. Preliminary results obtained with bromo- and chloro arenes are described.

The Palladium Catalysed Suzuki Coupling of 2- and 4-Chloropyridines

O. LOHSE, P. THEVENIN and E. WALDVOGEL, Synlett, 1999, (1), 45–48

Chloropyridines were shown to react smoothly with arylboronic acids in Pd-catalysed Suzuki couplings. Moderate to good yields of biaryls were obtained with 4-chloropyridines while 2-chloropyridines gave excellent yields. The reaction was easy to scale up and Pd(PPh₃)₄ could then advantageously be replaced in situ by Pd(0) generated from Pd(OAc)₂ and PPh₃, which showed even greater reactivity.

Fluoride-Catalyzed Reduction of Palladium(II) to Palladium(0)-Phosphine Complexes


Tetraco-ordinate Pd(0)-phosphine complexes are widely used in organic synthesis. In the presence of H₂O and excess PPh₃, fluoride ions catalyse the reduction of PdCl₂(PPh₃)₂ under mild conditions to form Pd(PPh₃)₄ in good yields. The inactivation of catalytic P⁺ by the formation of highly stable HF₂⁻, and of other polyhydrogen fluorides that can form in the reaction, was prevented by the addition of a strong non-ionic base, such as P(MeNCH₂CH₂)₃N.

Rhodium-Catalyzed Hydroformylation in Supercritical Carbon Dioxide


Supercritical CO₂ (scCO₂) was shown to be an environmentally benign medium for highly efficient Rh-catalysed hydroformylations. Olefinic substrates were hydroformylated in scCO₂ at 40 to 65°C, to the corresponding aldehydes in near quantitative yields with unmodified, phosphine-modified, and phosphite-modified systems. With unmodified Rh catalysts, the hydroformylation rates were considerably higher in scCO₂ than in organic solvents or liquid CO₂. Modified catalytic systems with perfluorooalkyl-substituted triarylphosphine and triarylphosphite ligands lead to higher regioselectivities than those found in conventional solvents. Olefin isomerisation, which is a typical side reaction for phosphite-modified systems in conventional solvents, was suppressed in scCO₂.
Hydroformylation of Allyl Ethers. A Study of the Regioselectivity Using Rhodium Catalysts
The hydroformylation of various allyl benzyl ethers was studied using the precursor catalytic system [Rh(q- S(CH₂)₃NMe₂)(cod)] + PR₃, where R is Ph, or O- o-t-BuC₆H₄, to obtain γ-, β- and α-hydroxylaldehydes. High yields and low regioselectivities were obtained in the hydroformylation of allyl benzyl ether using both R radicals. 4-Benzylloxy-3-methyl-butanal and 4-benzyloxy-2-methyl-butanal were obtained in good to excellent yields, starting from benzyl-2-methyl ether and benzyl-2-butenyl ether, respectively.

Ruthenium(II)-Catalyzed Asymmetric Transfer Hydrogenation of Ketones Using Chiral Oxazolinylferrocenylphosphines and One of Their Ru(II) Complex
Chiral oxazolinylferrocenylphosphines were shown to be efficient ligands for the Ru(II)-catalysed asymmetric transfer hydrogenation of alkyl aryl ketones and alkyl methyl ketones to give the corresponding alcohols in moderate yields with moderate-to-good enantiomeric excesses. A new Ru(II) complex containing a chiral oxazolinylferrocenylphosphine was prepared and is active for this hydrogenation.

FUEL CELLS
Morphology of Carbon Supported Pt-Ru Electrocatalyst and the CO Tolerance of Anodes for PEM Fuel Cells
Commercial 20% Pt-10% Ru/C and synthesised 10% Pt-5% Ru/C (YZU) catalysts at a Pt:Ru atomic ratio of 1:1 were examined for CO tolerance for applications in polymer electrolyte membrane fuel cells. Both half-cell tests under 250 ppm of CO/H₂, and single-cell tests under 100 ppm of CO/H₂, showed that the YZU catalyst had a smaller increase in the overvoltage at a given current. X-ray absorption spectroscopy studies showed no Pt-Ru metal-metal interaction in the commercial catalyst, and only RuO₂ signals were observed. In contrast, the YZU catalyst contained a Pt-Ru bimetallic interaction. It was considered that the Pt-Ru alloy structure has better CO tolerance than the non-alloyed Pt-Ru structure.

GLASS TECHNOLOGY
Investigating the Concept of Direct Heated Platinum Systems
M. BOTTEGER, Glass, 1999, 78, (1), 25–26
Direct-heated Pt systems (DHPS') used in the glass industry worldwide are described. The heating of the Pt tubes comprising the feeder is very important. The DHPS' concept is based on distributing one or more current supply electrodes to the Pt-tube, around its circumference, and attached at precise, geometrically defined points on the tube contact ring. This achieves a temperature which does not vary by > 1°C over the entire tube cross-section.

ELECTRICAL AND ELECTRONIC ENGINEERING
Observation of a Square Flux-Line Lattice in the Unconventional Superconductor Sr,RuO,
Small-angle neutron-scattering measurements of magnetic flux lines in the perovskite superconductor Sr,RuO₃ are reported. The magnetic flux lines form a square lattice over a wide range of fields and temperatures, as previously predicted by a theory of p-wave superconductivity in Sr,RuO₃. The theory also indicates that only a fraction of the electrons are strongly paired and that the orientation of the square flux lattice relative to the crystal lattice determines which parts of the 3-sheet Fermi surface of this perovskite material are responsible for superconductivity. The results suggest that superconductivity resides mainly on the γ' sheet.