Thin-film electrocatalyst for unitized regenerative PEMFCs

Thin-film electrocatalyst layers with varying PTFE and Nafion contents for unitized regenerative PEM fuel cells (URFCs) made using the paste method were examined as URFC electrodes. Adding Ir catalyst to the oxygen electrode layer significantly improved performance. Catalyst loadings can be reduced to <1/3 using this method.
T. Ioroi, K. Yasuda, Z. Siroma, N. Fujiwara and Y. Miyazaki: *J. of Power Sources* 112(2) 583–587 (14 November 2002).

Steam reforming of hydrocarbons on Ni-YSZ cermet SOFC anodes

This study investigated the effect of MgO, CaO, SrO and CeO_2 addition to Ni-YSZ cermets on their catalytic activity and carbon deposition in steam reforming. Adding CaO slightly reduced anode electrochemical activity, but suppressed carbon deposition and promoted steam reforming.
T. Takeguchi *et al.*: *J. of Power Sources* 112(2) 588–595 (14 November 2002).

Methanol conditioning for improved formic acid fuel cell performance

Here methanol conditioning is shown to be more effective than hydrogen conditioning for activation of fuel cells for formic acid, and improves direct formic acid fuel cell performance.
S. Ha, C.A. Rice, R.I. Masel and A. Wieckowski: *J. of Power Sources* 112(2) 655–659 (14 November 2002).

Inclusion of Mo, Nb and Ta for improved CO-tolerant PEMFC anodes

The effect of including Mo, Nb and Ta in Pt and PtRu carbon-supported anode electrocatalysts on CO tolerance in PEM fuel cells was investigated. While all the catalysts exhibited enhanced performance over Pt/C, adding a small amount of Mo to PtRu gave a more active electrocatalyst than PtRu/C in the presence of CO.
D.C. Papageorgopoulos, M. Keijzer and F.A. de Bruijn: *Electrochimica Acta* 48(2) 197–204 (21 November 2002).

Correlation of PtRu electrocatalyst properties for PEMFCs

This work discusses PtRu/C electrocatalysts obtained via formation of a sulfide complex method and submitted to thermal treatment in reducing environments. Modifying the catalyst structure by increasing the heat treatment temperature, despite the reduced active surface area, gives the best CO tolerance for ca. 3:1 Pt:Ru alloy.
G.A. Camara, M.J. Giz, V.A. Paganin and E.A. Ticianelli: *J. of Electroanalytical Chemistry* 537(1/2) 21–29 (29 November 2002).

CO tolerance of Pd-rich PtPd carbon-supported electrocatalysts

The use of carbon-supported $PtPd_y$ (y = 1–6) electrocatalysts as CO-tolerant PEMFC anodes was investigated. It was found that on CO saturation, fewer surface sites are poisoned for $PtPd_y$ than for Pt, for more adsorbed hydrogen.
D.C. Papageorgopoulos, M. Keijzer, J.B.J. Veldhuis and F.A. de Bruijn: *J. Electrochem. Soc.* 149(11) A1400–1404 (November 2002).

Voltage oscillations in PEMFCs with PtRu anode catalyst

Sustained voltage oscillations are observed in a PEMFC with PtRu anode catalyst and with H_2/108 ppm CO anode feed operating at constant current density at <70°C. The oscillations are believed to be due to coupling of H_2 and CO anode electro-oxidation on the PtRu surface.
J. Zhang and R. Datta: *J. Electrochem. Soc.* 149(11) A1423–1431 (November 2002).

DMFC using pore-filling membrane/electrode integrated system

This approach to develop a high-performance DMFC uses a pore-filling polymer membrane, where the polymer is filled into a porous substrate to make an integrated membrane/catalyst layer system. The substrate matrix suppresses membrane swelling to reduce methanol crossover, and shows high-temperature mechanical strength.
T. Yamaguchi, M. Ibe, B.N. Nair and S.-I. Nakao: *J. Electrochem. Soc.* 149(11) A1448–1453 (November 2002).

Ni catalyst for hydrogen conversion in Gd-doped ceria SOFC anodes

Gadolinia-doped ceria $Ce_{0.6}Gd_{0.4}O_{1.8}$ (CG4) is considered for SOFC anodes with YSZ electrolyte. Two rate-limiting processes were observed. The low-frequency process is related to hydrogen adsorption on the CG4 surface, circumvented by adding Ni, while the high-frequency process is related to CG4 oxygen ion transport.
S. Primdahl and Y.L. Liu: *J. Electrochem. Soc.* 149(11) A1466–1472 (November 2002).

IT-SOFC using Y-doped $BaCeO_3$

The performance of an SOFC comprising 3 wt% Pd-loaded FeO–25 mol% Y^{3+}-doped $BaCeO_3$ (BCY25)–$Ba_{0.5}Pr_{0.5}CoO_3$ was studied at 350–600°C. BCY25 showed higher ion conductivities than 8 mol% YSZ below 800°C and 20 mol% Sm^{3+}-doped ceria (SDC) below 600°C, with the smallest ohmic resistance loss during cell discharge and the highest peak power density below 600°C among the three electrolytes.
T. Hibino, A. Hashimoto, M. Suzuki and M. Sano: *J. Electrochem. Soc.* 149(11) A1503–1508 (November 2002).

Electrical properties of Fe-substituted $La_{6.4}Sr_{1.6}Cu_8O_{20+\delta}$

$La_{6.4-x}Sr_{1.6+x}Cu_{8-x}Fe_xO_{20+\delta}$ ($0 \le x \le 2$) perovskite-related cuprates were investigated for use as SOFC cathodes. These materials have a peak room-temperature conductivity of 1.46×10^3 S/cm for undoped material, dropping to 5.0×10^2 S/cm at 770°C, inviting further investigation.
S.J. Skinner and C. Munnings: *Materials Letters* 57(3) 594–597 (December 2002).

Composite Nafion/PVA membranes

Methanol crossover in DMFCs can be reduced by casting a thin film containing a PVA/Nafion mix on Nafion. At a 1:1 PVA:Nafion weight ratio, the coated Nafion membrane exhibits low methanol crossover, and the membrane conductance can be improved by sulfonation.
Z.-G. Shao, X. Wang and I.-M. Hsing: *J. Membrane Science* 210(1) 147–153 (1 December 2002).

Fuel processing for transportation and portable fuel cell systems

This paper reviews the reforming options for generating H_2 from hydrocarbon fuels, the development of new reforming catalysts, and the design of fuel processors for small fuel cell systems.
M. Krumpelt, T.R. Krause, J.D. Carter, J.P. Kopasz and S. Ahmed: *Catalysis Today* 77(1/2) 3–16 (1 December 2002).

Fuel processing for low- and high-temperature fuel cells

This review of fuel processing suggests areas for R&D. More effective deep removal of sulfur before and after reforming, energy-efficient and stable autothermal reforming catalyst and processing schemes, more active and non-pyrophoric WGS catalysts, more CO-tolerant anode catalysts or MEAs operating at higher temperatures would contribute significantly to better PEM fuel cells.
C. Song: *Catalysis Today* 77(1/2) 17–49 (1 December 2002).

Steam reforming of hydrocarbons

This work reports on a proprietary steam reforming catalyst for use with PEM fuel cells, tested on various hydrocarbons. The catalyst has very stable performance for steam reforming of iso-octane, hexadecane and natural gas, without deactivation or carbon deposition. The catalyst has substantially improved sulfur resistance compared to current steam reforming catalysts.
Q. Ming, T. Healey, L. Allen and P. Irving: *Catalysis Today* 77(1/2) 51–64 (1 December 2002).

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