80°C (atmospheric) or 95°C (4–5 atmospheres) without drying out the membrane. This means that noble metal catalyst poisons, such as hydrogen sulphide and carbon monoxide, cannot be tolerated at any level. With pure hydrogen, however, the reaction rate for dissociation of the hydrogen molecule on platinum is so high that very little platinum is required, and electrodes can be formed with the platinum catalyst close to the SPE surface. Improvements in the conductivity and water retention of the SPE are produced by using the lower equivalent weight (more sulphonic acid groups per polymer molecule) Dow membrane, rather than the DuPont Nafion membrane. By identifying problems and applying various solutions, it is possible to reach a cell potential of 0.62 V at 2000 mA/cm^2 at 95°C and 5 atmospheres pressure with pure hydrogen and oxygen.

Alkaline Fuel Cells

The final speaker of the meeting was Dr. Pehr Björnbom from the Royal Institute of Technology, Sweden, who described fundamental systems and technology results relating to alkaline fuel cells (AFC). Here, comparison of system studies for alkaline fuel cells with the carbon dioxide rejecting electrolyte systems of PAFC, MCFC and SOFC indicate that AFCs may be cost competitive, even after the cost of carbon dioxide removal. Fundamental studies were done of the individual electrode and cell operations, separating the various ohmic and diffusional characteristics which can then lead to efficient operation.

It was unfortunate that the date of this meeting coincided with that of the Grove Fuel Cell Symposium in London, England (*Platinum Metals Rev.*, 1989, **33**, (4), 169–177) effectively excluding many possible attendees from Europe, while retaining many prominent fuel cell personalities in Japan. Nonetheless this first International Fuel Cell Workshop represented a powerful demonstration of the state-of-the-art for fuel cell technology.

The Proceedings of the Workshop have been published, and are available from the organising committee, First International Fuel Cell Workshop, c/o Laboratory for Electrocatalysis for Fuel Cells, Faculty of Engineering, Yamanashi University, Takeda 4–3, Kofu 400, Japan; or from Stonehart Associates Inc., PO Box 1220, Madison, CT 06443, U.S.A.; price U.S.$75.00.

A Novel Device for Energy Conversion

News of an interesting new fuel cell concept, using thin-film devices for energy conversion, was presented at the Grove Anniversary Fuel Cell Symposium by Dr. C. K. Dyer of Bell Communications Research (1), and further details have since been published (2, 3). The devices consist of two platinum electrodes deposited on either side of very thin (<50 μm) gas permeable and ion conducting membranes.

One electrode in the fuel cell is deposited on an impermeable support, such as quartz. The membrane separator is applied, and an upper porous electrode is then laid over it. When this upper electrode is exposed to hydrogen and oxygen or air mixtures, a potential of up to one volt is observed between the electrodes, and currents of 2 to 3 mA/cm^2 may be drawn.

Lower performances are achieved using electrode pairs of palladium/platinum, palladium/palladium and platinum/nickel, with open circuit voltages of 740 mV, 450 mV and 600 mV, respectively. Significantly, using methanol vapour as a fuel in pure oxygen, up to 640 mV can be obtained at atmospheric temperature and pressure, with platinum electrodes.

Although specific power levels are relatively low (1 to 5 mW/cm^2), each assembly is extremely thin, and hence power densities of 100 W/kg of fuel cell are presently obtainable, and 1000 W/kg appears possible.

The author foresees simply constructed, inexpensive fuel cells, operating on mixed fuel/oxidant gases fulfilling a range of functions from replacing high-use batteries, to new applications in information processing.

D.S.C.

References

1 C. K. Dyer, "The Grove Anniversary Fuel Cell Symposium", London, September 1989, published in *Platinum Metals Rev.*, 1989, **33**, (4), 169

2 C. K. Dyer, *Nature*, 1990, **343**, (6258), 547

3 T. E. Mallouk, *ibid.*, 515