

Platinum Metals in Electrochemistry

FURTHER WORK ON ELECTROCATALYSTS REPORTED

The Electrochem '95 Conference, organised by the Society of Chemical Industry and the Royal Society of Chemistry was held at the University of Wales, Bangor, from 10th to 14th September 1995. During the week, parallel minisymposia covered the topics of: structure and reactivity at interfaces, electrochemical processing, polymers and novel materials, fuel cells and electrocatalysis, corrosion, solid state ionics and batteries, semiconductor electrochemistry, electroanalytical chemistry and environmental electrochemistry. Of the approximately 260 delegates, less than 10 per cent were from industry, which must be a cause for concern. Not surprisingly then, developments in new instrumentation dominated much of the proceedings, and the latest advances in techniques, such as FTIR, EXAFS, STM and AFM, are certainly striking. However, one felt occasionally that some simple "wet chemistry" would have given just as much, if not more, insight into the fundamental science in question.

Technical Presentations

The group at Bath University lead by Professor L. M. Peter has been studying various industrially-relevant systems including (together with ICI) the kinetics of chlorine evolution on titanium/ruthenium anodes. In this instance, the less familiar open-circuit potential decay method was used to elucidate important parameters such as the Tafel slope and exchange current density. Among the results that his group achieved were: the identification of an activity threshold effect dependent upon the ruthenium content (with the number of active sites being dependent upon how "hard" the electrode is driven) and the discovery that chlorine can evolve without charge transfer occurring.

A team from Newcastle University lead by Professor A. Hamnett and P. A. Christensen produced results on a number of aspects of electrocatalysis in fuel cells, including modelling the performance of a solid polymer direct methanol fuel

cell, and the development of new oxygen reduction catalysts. The power output from a vapour-fed methanol single cell was reported to be around 200 mW/cm² at 113°C with 2 bar air, 5 M methanol and a catalyst loading of 2.5 mg Pt/cm². Methanol cross-over from the anode to the cathode remains a problem, and another restriction to cell performance may arise from proton conduction limitations at the membrane/catalyst interface. Improved platinum and platinum/ruthenium catalysts supported on carbon for methanol oxidation were obtained by deposition from aqueous sulphito complexes, using hydrogen peroxide as the reducing agent. In addition, the Newcastle group are studying ruthenium/molybdenum based metal chalcogenide catalysts, made by the reaction of the metal carbonyls in xylene; they continue to show promise as novel oxygen reduction catalysts with acid stability.

Another catalyst issue of practical importance, the dependency of intrinsic activity on particle-size for oxygen reduction, was described by R. J. Potter of Johnson Matthey during a presentation of technical issues in the hydrogen-air solid polymer fuel cell system. Work on dimensionally stable anode materials in which the service life of PdO/titanium electrodes for oxygen evolution in alkali solutions was significantly improved by the addition of zinc, was discussed by B. J. Hwang from the National Taiwan Institute of Technology.

In another presentation from Newcastle University, by K. Scott and W. M. Taama, palladium was again described as an effective anode catalyst, this time for the anodic oxidation of sulphur dioxide in sulphuric acid.

A number of groups are working on the development of conducting polymers containing redox active metal centres, which include ruthenium, osmium and platinum, where the main application is in sensor technology.

The next conference will be held at Bath University, and one hopes that this time there will be a greater presence from industry. R.J.P.