Delegate Manual

Seventh Grove Fuel Cell Symposium

Commercialising Fuel Cells: The Issues Outstanding

11–13 September 2001

Queen Elizabeth II Conference Centre
Westminster, London, UK

Organised by:

Official publications:

Fuel Cells Bulletin

REFOCUS

Sponsored by:

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Donaldson Company Inc. has developed an unique contamination control system for cathode air in PEM fuel cells, that incorporates sound suppression of the noise emitted by air handling compressors, blowers, fans and expanders. An ambient air quality database identifying average and maximum concentration of various contaminants for locations around the world was established. Research on the effects of cathode air contaminants on the performance of PEM fuel cells was compiled. The ability to identify contaminants which effect fuel cell performance and reliability, along with technology in high efficiency filtration of particulate matter, oils, salts and chemicals; computational fluid dynamics (CFD), and acoustics were incorporated in the development of our systems.

[P2a.39]

Flow field design and testing for PEM bipolar plate

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Bipolar plates in proton-exchange membrane (PEM) fuel cell achieve various requirements as the homogeneous reactant flow distribution over the entire anodic and cathodic areas and the effective water management and removal. During operation cell performance may be adversely affected by the formation of liquid water, due to water flooding and uneven gas flow distribution. At the same time the pressure drop across bipolar plate should be minimised to reduce the energy requirements of the auxiliary units such as pumps and compressors (or fans).

Among various water management techniques (stack operating conditions, membrane electrode assembly design, advanced humidification techniques etc.), the design of bipolar plate flowfield was thus focused. The fluid dynamics behaviour of gas flow has been investigated, theoretically and experimentally, in order to develop a modelling tool for gas flow distribution schemes. Modelling approach was based on classical pressure drop calculations, considering various contributions at total pressure drop along the gas path. Special emphasis was given to cathodic site for the more critical water management problems. Parameters for friction loss calculations were checked and/or evaluated against experimental data obtained from testing from a commercial bipolar plate installed on a single PEM cell.

Based on the tested fluid dynamic model, a first novel design of the gas flow distributor has been designed with the aim to have an effective and continuous water removal at lower stoichiometric ratio, always operating at low pressure drop levels. The plate with the new oxidant gas distribution system is tested in our laboratory for assessment against the flow distributor in the present commercial fuel cell. Results of the fluid dynamics and its influence on electrochemical behaviour will be illustrated and discussed.

[P2a.40]

Investigation of Corrosion Resistance for Coatings of Ni, Al, TiN on Steel 12H18N10T in Operation of Separator MCFC Plate

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Electrochemical generator on the base of high temperature molten carbonate fuel cells (MCFC) is one of the most promising energy sources due to its ecologically purity, high efficiency and absence of expensive catalysts of noble metals. Low corrosion resistance of its metal structures is one the main problems hindering commercialization of power plants with MCFC. This problem is solved either by a development of new allows or by applying of matching protective coatings on stainless steels of metal structures.

During the work the corrosion resistance was studied for effective protective coatings produced by different methods for separator MCFC plates of stainless steel 12H18N10T. To protect anode part of a separator MCFC plate, the coatings of Ni and TiN were considered, and, to prevent its periphery part (sealing area), - coatings of Al. A wide range of methods was studied. Nickel coatings were applied by methods of galvanic deposition, explosive plating, magnetron spattering, gas flame deposition. Aluminum coatings were applied by thermal diffusion, emulsion, gas-flame and magnetron methods. Coating of TiN was produced by a cathode deposition method.