Evaluation of the activity of Pt–Ru electro catalysts based on LyFlex®Gas Diffusion Layer for the electro-oxidation of methanol

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The gas diffusion layer (GDL) is vital to the performance and durability of direct methanol fuel cell (DMFC). The GDL plays an important role in water management, catalyst efficiency and conductivity of DMFC. The GDL consists of a carbon substrate that can either be woven or non-woven. The various substrates used to produce GDLs result in very different physical characteristics, particularly surface characteristics. At the present, the most well known GDL substrate used in DMFC is that produced by Toray of Japan. This substrate is a pyrolysed non-woven carbon-fiber sheet which offers very good conductive properties and low elongation but with limited resistance to brittle fracture. Another approach to GDL manufacture is to use a woven carbon cloth as the substrate, the best-known example being Elat from Etek. The cloth is produced using highly conductive fibers, which are then loaded with carbon black. Cloth based GDLs have the advantage of being very flexible and durable but their tendency to stretch can make automated assembly of a stack rather difficult. The woven substrates also tend to be more expensive than similar non-woven sheets.

A rather different approach has been taken by Lydall in the manufacture of LyFlex GDL. The substrate is again a non-woven carbon sheet but does not need to be pyrolysed and remains very flexible. The GDL has the advantages of being very flexible, good conductivity and durable. As there are no high-temperature post-processes, this not only eliminates a costly production step but also creates a highly integrated micro-porous structure with very high surface area.

In this study, the kinetics of methanol oxidation on Pt-Ru / carbon powders based on LyFlex Gas Diffusion Layer is evaluated using a mixture of 0.5 M H2SO4, and 2M CH3OH in which formic acid is added. A rotating ring-disk electrode technique is used to determine kinetic parameters for CH3OH electro oxidation. Kinetic parameters such as the kinetic current, Tafel slope, and the rate constant for oxidation of intermediate CO are determined.

The results indicate greater activity of Pt-Ru/carbon powders based on LyFlex Gas Diffusion Layer in comparison with the Toray's GDL.