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Vassiliev, Anton; Andersen, Kjeld Bøhm; Martin, S.; Cleemann, Lars Nilausen; Jensen, Jens Oluf

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Methods for HT-PEM FC electrodes preparation and their influence on MEA activity

Anton Vassiliev, Santiago Martin, Kjeld Bøhm Andersen, Lars Nilausen Cleemann and Jens Oluf Jensen

Department of Energy Conversion and Storage, Technical University of Denmark, Denmark

The preparation of the catalyst inks for HT-PEM fuel cells has been limited to use of dimethylacetamide (DMAc), N-Methyl-2-pyrrolidone (NMP) or formic acid as solvents due to their ability to dissolve polybenzimidazole (PBI), which has long been considered necessary to obtain sufficient proton conductivity in the catalyst layer of the electrodes. Addition of most other substances would cause PBI to precipitate, rendering the ink useless and limiting the options to optimize the structure of the catalyst layer in terms of e.g. porosity or hydrophobicity.

Recently it has been shown that a catalyst layer containing only the Pt/C catalyst without any binder exhibits similar performances in an MEA made by traditional methods [1]. This opens up for using a wide variety of solvents, binders, porogens and other additives to modify and improve the structure and properties of the catalyst layer of the electrodes.

Present work gives an overview of different catalyst ink compositions and deposition techniques and their influence on HT-PEM fuel cell performance, durability and CO tolerance. Single cell tests have shown that MEAs prepared without PBI as a binder in the catalyst layer results in higher power densities, especially at higher currents. Durability HT-PEM FC studies at 200 mA/cm² have shown a fast break-in and no net voltage decay after 1500 hours of operation.

[1] S. Martin, Q. Li, T. Steenberg and J.O. Jensen, *Binderless Electrodes for High-Temperature Polymer Electrolyte Membrane Fuel Cells*, submitted for publication to the Journal of Power Sources.