Abstract for oral presentation

Numerical Determination of Transport Properties of Catalyst Layer, Microporous Layer and Gas Diffusion Layer

Jürgen Becker*'[1]

[1]Math2Market GmbH, Kaiserslautern, Germany
*Presenting author, email: juergen.becker@math2market.de, Tel.: +49 631 68039345

The performance of a PEM fuel cell depends essentially on the transport properties of the porous layers that form the MEA. Therefore, the connection between 3D pore structure and transport property needs to be understood and can then be exploited to create optimal layers. For this, two things are necessary:

A) To determine the effective transport properties based on 3D images.
In this talk, I will shortly summarize which methods were used to determine the transport properties of GDL [1] and MPL [2]. Then, I will show how transport properties can be determined from FIBSEM images of catalyst layers [3].

B) To create 3D structure images virtually.
This ability can be used to study systematically the connection between 3D pore structure and transport property, e.g. how does the MPL porosity and thickness influence the diffusivity of the layer? In this talk, I will present results from a recent design study [4] performed with GeoDict [5].

References:

[1] J. Becker, R. Flückiger, M. Reum, F.N. Büchi, F. Marone and M. Stampanoni, J. Electrochem. Soc. 156, pp. B1175-B1181, 2009.
[2] J. Becker, C. Wieser, S. Fell and K. Steiner, Int. J. Heat Mass Transfer 54, pp. 1360-1368, 2011.
[3] T. Hutzenlaub, J. Becker, R. Zengerle and S. Thiele, J. Power Sources 227, pp 260-266, 2013.
[4] N. Zamel, J. Becker and A. Wiegmann,, J. Power Sources 207, pp. 70-80, 2012.
[5] GeoDict, The Virtual Material Laboratory, www.geodict.com

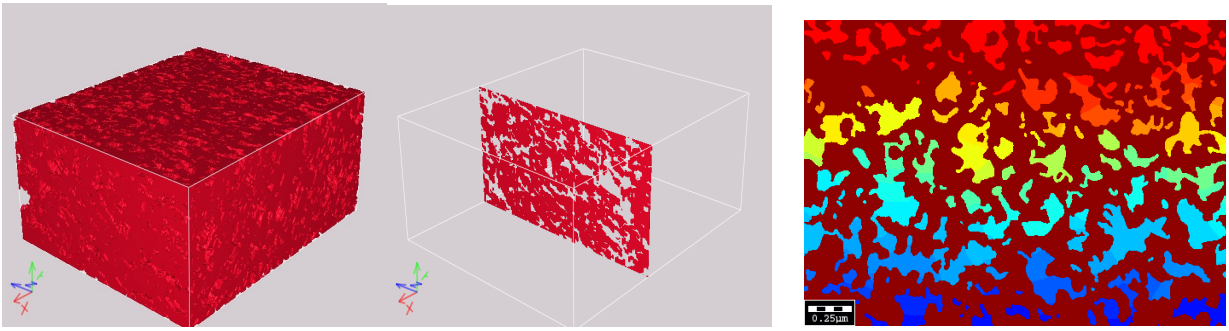

Figure: Left: 3D structure of a catalyst layer, reconstructed from FIB/SEM images[3]. Right: diffusion in the catalyst layer pores: numerically determined concentration distribution.