

APPLICABILITY OF CARMAN-KOZENY EQUATION IN PREDICTION OF GDL PERMEABILITY

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Hydrogen fuelled fuel cells represent an important part of the new energy scheme for low emission society. Development of the more efficient, durable and energy dense systems requires precise information on the numerous aspects, especially on the local distribution of local physico-chemical quantities inside the fuel cells stacks. It is extremely difficult to obtain such information experimentally. Therefore, the mathematical modelling is coming to the word. It offers an efficient and versatile way for required information acquisition. Every mathematical model accuracy, however, is primarily determined by the accuracy and reliability of the input data available. This concerns not only kinetic parameters etc., but also materials and components characteristics. In the case of this particular contribution, permeability of gas diffusion layer for reactants and products is in the spot of interest. Permeability values of porous environment are available experimentally. It is, however, important to keep in mind that permeability value is strongly dependent on the material porosity and thus on its degree of compression inside the stack. Therefore, permeability value is varying with position along the electrode. In order to ensure sufficiently accurate results, suitable approach to describe smoothly variation of the gas diffusion layer permeability with degree of its compression is desirable. Traditional approach is to use suitable semi-empirical equations. In this particular case, Kozeny-Carman equation was chosen as a feasible approach. Despite the frequent use of this equation, for the given purpose, its reliability and accuracy were not truly tested and verified. It is a purpose of this work to contribute to fill in this gap.

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