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Effect of Phase Change in Gas Diffusion Layer on Performance of a PEM Fuel Cell –a modelling study

Wednesday, 24 May 2023 10:30 (1h 30m)

Research on the advancement and optimization of the PEMFC for commercialization centers around improving one or more of its limitations which include slow oxygen reduction kinetics, poor heat and water management, CO poisoning, and sourcing high-quality hydrogen as a fuel. Water management and subsequent improvement of oxygen reduction kinetics have been studied experimentally, numerically, and using computational models.
Several studies have proposed various options to improve the functioning of individual components of PEM fuel cells such as membrane coatings, catalyst type, gas channel shape (e.g., tapered), GDL microstructure, and as well as change of operating conditions. It has been proposed that regularly ordered structures in a GDL will allow for smaller mass transfer loss and ohmic losses thereby improving the fuel cell performance [1]. However, whether phase change (evaporation of water in GDL and condensation of vapor gas in GDL) can make a significant role in the efficiency of the PEM fuel cells is the question to be addressed in this study. In this study, using OpenFOAM coupled with the Volume of Fluid (VoF) method to simulate two-phase flow in the void space porous structure with and without phase change is simulated. The objective is to show the critical conditions when the phase change can have a detrimental role in the prediction of water management in GDLs.
References
1. Niblett, D.; Niasar, V.; Holmes, S. Enhancing the Performance of Fuel Cell Gas Diffusion Layers Using Ordered Microstructural Design. Journal of The Electrochemical Society 2020, 167, 013520.

Participation

In-Person

References

1. Niblett, D.; Niasar, V.; Holmes, S. Enhancing the Performance of Fuel Cell Gas Diffusion Layers Using Ordered Microstructural Design. Journal of The Electrochemical Society 2020, 167, 013520.

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