SIMULATION OF HEAT AND MASS TRANSPORT IN GAS FLOW STREAMS OF A PEMFC FROM A WATER MANAGEMENT PERSPECTIVE

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With the current state of energy costs associated with the transportation sector, Proton Exchange Membrane (PEM) fuel cells are gaining popularity as a potential replacement for the internal combustion engine. In this role, maximum performance will be expected from the fuel cell. Performance can be significantly affected by the amount of liquid water present in the fuel cell, which makes proper water management critical in its efficient operation. Temperature gradients across fuel cell components can result in changes in the concentration and phase of water, thus closely coupling heat transfer with water management. This research presents an in-depth literature review of available PEM fuel cell transport models, basic governing equations used in each model's development, and a first order model developed to account for heat and mass transfer issues found in literature. It was found that the majority of models neglect the anisotropic properties of the Gas Diffusion Layer (GDL) and the liquid water interactions in the gas channels. A one-dimensional steady state model was proposed to analyze heat and mass transport in the GDL. The model provides a basis with which to address several issues regarding modeling of the GDL and flow within the gas channels. This work provides a foundation for developing advanced models to simulate water management in future work.