Proceedings of the Canadian Society for Mechanical Engineering International Congress
Computational Fluid Dynamics Canada International Congress
CSME - CFD-SC2023
May 28-31, 2023, Sherbrooke, QC, Canada

Bipolar Plate Design of Low Temperature Fuel Cells by the Assistance of Computational Fluid Dynamics

Amirhossein Amirsoleymani , Xianguo Li *
Department of Mechanical and Mechatronics Engineering, University of Waterloo, Waterloo, Canada

ABSTRACT

Proton Exchange Membrane Fuel Cell (PEMFC) is the low-temperature type of fuel cell that generates electrical power through the electrochemical reactions. Bipolar plates (BP) are the crucial component of PEMFC which provides the path for the transport of reactant gases to the whole active area of the Fuel Cell. Poor flow-field design can lead to non-even distribution of gas flow in the cell, which can result in reactants starvation at the local area of the active cell. In addition, the pressure drop of the fuel cell system is highly dependent on the BP design, specifically when multiple cells are sandwiched together in series in the stack. Therefore, obtaining optimal flow-field pattern would be necessary for optimal design at the cell level to increase the performance and reliability of the system at the stack level. Although numerical modelling and simulation via the computers made it possible to analyze the performance and reliability of fuel cell before any fabrication, or build and test, in reality detailed numerical calculation would be challenging and expensive. Therefore, this study focuses on 2D simulation with adopting engineering assumptions to analyze the reactant flow inside the BP at the cathode side, and various possible designs of BP with different flow-field patterns are simulated and analyzed. The details of the present study will be presented at the conference.