Proceedings of CHT-17
ICHMT International Symposium on Advances in Computational Heat Transfer

May 28-June 1, 2017, Napoli, Italy

CHT-17-258

EFFECT OF BIPOLAR PLATE FLOW CHANNEL ON THE PERFORMANCE OF A PROTON EXCHANGE MEMBRANE FUEL CELL: A NUMERICAL STUDY

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ABSTRACT This paper mainly focuses on the results of numerical investigations carried out on a Proton Exchange Membrane (PEM) fuel cell to examine the effect of bipolar plate flow channel on its performance. The three dimensional numerical model of the bipolar plate in a PEM fuel cell with serpentine flow field has been used for the study. Numerical investigations on various landing to channel ratios (L:C) for flow filed of bipolar plates in a PEM fuel cell of 70cm^2 active area is considered in order to find the best flow channel design. The numerical model is three dimensional steady, incompressible, single phase and isothermal. The numerical model includes the governing equations of mass, momentum, energy and species. All the pertinent equations are simultaneously solved using ANSYS Fluent 15.0, in order to get power density in the 1:1, 1:2, 2:1, 2:2 (L : C) flow channel of bipolar plate. In the present study, serpentine flow field with a landing to channel ratio of 1:1 gives the maximum power density of 0.517 W/cm^2 at 0.4 V. The effect of variation in the active area of the flow field in the bipolar plate of the PEM fuel cell has also been discussed.