Performance of Hybrid Al_2O_3:SiO_2 W:EG in PEM Fuel Cell Distributor Plate

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ABSTRACT

Efficient thermal management is essential for the optimal performance and durability of the Proton Exchange Membrane Fuel Cell (PEMFC). However, the conventional passive cooling methods require a larger heat exchanger for better heat dissipation. Alternatively, nanofluids as a coolant have gained attention recently due to their enhanced heat transfer properties. This investigation aims to evaluate the thermal performance of hybrid nanofluids in a distributor type of PEMFC cooling plate. In this investigation, 0.5% volume concentration of mono Al_2O_3, mono SiO_2 nanofluids, and hybrid Al_2O_3:SiO_2 nanofluids with a mixture ratio of 10:90, 30:70, 50:50, and 70:30 in 60:40 W:EG were investigated. The cooling plate was modelled and a fixed heat flux of 6500 w/m^2 was applied to replicate the actual working parameter of PEMFC. The study shows that the heat transfer coefficient was improved by 61% in 10:90 hybrid nanofluids of Al_2O_3:SiO_2 in W:EG in comparison to the base fluid. Meanwhile, the accompanied pressure drops in 10:90 hybrid nanofluids of Al_2O_3:SiO_2 in W:EG show a reduction up to 4.38 times lower as compared to single Al_2O_3 nanofluids at Re 1800. This is advantageous since it will reduce the parasitic loss related to the PEM fuel cell.

Keywords: *Hybrid Nanofluids; Heat Transfer Enhancement; Pressure Drop; PEMFC*

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