Effect of different flow field designs and number of channels on performance of a small PEFC

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Abstract
An improper designed flow field of a polymer electrolyte fuel cell (PEFC) can cause the maldistributions, resulting in the reduction of PEFC performance and lifetime. Although there are several researches investigating the effect of flow field design, the parallel in series flow fields have, however, received a very low attention. In this study, a numerical investigation on the distributions in six different flow field designs over 5 cm2 PEFC has been systematically carried out using CFD techniques via ANSYS FLUENT software to study the effect of different flow field configurations and number of channels. The results revealed that, for a small-size PEFC, the flow fields with less number of channels provided both a better uniformity and cell performance. Although the number of channels affects the small-size PEFC performance much greater than the flow field geometric configurations, the further investigation revealed that the influence of configurations will be greater as the number of channels increases. In addition, with the same number of channels, the parallel in series flow fields performed better than the multi-channel serpentine flow fields in both uniformity and water management aspects as their geometry provided higher reactant flow velocity.

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