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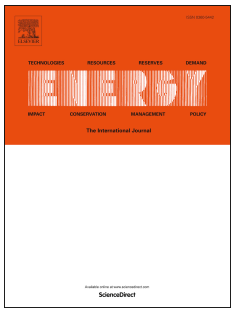

Advanced exergy analysis for an anode gas recirculation solid oxide fuel cell

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Advanced Exergy Analysis for an Anode Gas Recirculation Solid Oxide Fuel Cell

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Abstract

Advanced exergy analysis is performed for a solid oxide fuel cell with anode gas recirculation. For this purpose, the unavoidable conditions are determined by specifying the most important electrochemical parameters resulting in the best possible performance. It is observed that, under the unavoidable conditions, the fuel cell exergy efficiency can be 32% higher and the exergy destruction can be 38% lower, compared to the corresponding values under real conditions. The analysis revealed the values of first level splitting of exergy destruction including the avoidable/unavoidable and endogenous/exogenous exergy destructions for all the system components. In addition, the second level splitting of exergy destruction including the unavoidable endogenous, unavoidable exogenous, avoidable endogenous and avoidable exogenous exergy destructions are determined for all the system components. The results show that of the total exergy destruction in the system, 62% is endogenous and 38% is exogenous. Also, 54% of the total exergy destruction is avoidable and the rest, 46%, is unavoidable. In addition, it is observed that the order of component contribution in the total avoidable endogenous exergy destruction of the system is: the inverter, 6.52 kW, the stack, 3.6 kW and the afterburner, 0.62 kW. This result is different from that obtained from conventional exergy analysis suggesting that attention should be paid first on the stack, then on the afterburner and afterward on the inverter.

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