Transport phenomena and performance of solid oxide fuel cell(SOFC) using 3-D simulations

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Development of fuel cells has attracted the researchers' interests in both academia and industry. Among the several kinds of fuel cells, solid oxide fuel cell (SOFC) which can be operated under high temperature condition is featured by no need of noble metal catalyst and the usage of various fossil fuels in reforming process. Accordingly, SOFCs have been widely explored as one of promising energy sources against forthcoming energy crisis. The main work of this study is to perform the numerical analysis for correctly elucidating internal dynamics of SOFC supporting the experimental data. From three-dimensional simulations, polarization curves have been established, illustrating the performance of single cell in terms of current density and actual voltage implemented with activation and ohmic overpotentials, and compared with published experimental data. Also, the role of process conditions enhancement of cell performance and efficient strategy for fuel utilization has been investigated by changing the operating temperature, inlet fuel conditions, and cell geometry.