Percolation Micro-Model to Predict the Electrochemical Properties of Composite Anode and Cathode in Protonic Ceramic Fuel Cell

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As one of the potential alternatives to reduce the operation temperature of solid oxide fuel cell (SOFC) to the intermediate temperature range, protonic ceramic fuel cell (H^+ -SOFC or PCFC) has received more and more attention. Because there is lower activation energy of protons transport than that of oxygen ions, the vapor is produced within the cathode side instead of anode side. It means that there are different relations among the microstructure parameters, electrode properties and multi-physics working processes within fuel cells, compared with the traditional high temperature O^{2-} -SOFC and low temperature proton exchange membrane fuel cell (PEMFC). In this paper, the percolation micro model is adopted to study the effects of the microstructure parameters on the detail effective multi-physics transporting and electrochemical properties of PCFC binary component anode and cathode. It would be helpful to quantitatively understand the influence of microstructure factors on PCFC operation and further apply the understanding to the design and fabrication of composite electrode microstructure as the approach to achieve a high PCFC performance.

Keywords: Protonic ceramic fuel cell; Percolation theory; Porous composite electrode microstructure; Multi-physics transporting and electrochemical properties

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