New structure of cathode function layer of SOFC by nanoporous columnar YSZ films

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Abstract

The Solid Oxide Fuel Cell (SOFC) is an electrochemical device operated at high temperature(500-900℃), it transforms the chemical energy stored in fuels into electrical energy and heat. The first element of fuel cell industry is reduce the SOFC to 400-600℃. We realize the nanoscale interface to enhance the conductivity effect by nanostructure of the electrode function, thereby we find a new way to explore new cathode functional layer materials and new structure.

We prepare high-quality nanoporous columnar YSZ thin films with open gap by reactive magnetron sputtering in combination with glancing angle deposition (GLAD) on the surface. The influences of deposition angle on the structural properties of YSZ films were investigated. It was found that the YSZ films fabricated using GLAD showed a tilted columnar microstructure. The width of the gap between two adjacent columnar crystals was around 100nm. The average grain size of YSZ films was about 10-20 nm. The orientation of some grains could be changed by changing the deposition angle. Then the nano-particles of the cathode material id impregnated into the pores by Nano-impregnation method. This will certainly improve the functional layer of SOFC interface by nanoscale, and realize the new structure of cathode functional layer which can improve fuel cell performance and reduce the operating temperature.

We still need do more experiments combined with theoretical analysis, to understand the principle of the cathode functional layer process and application.