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Effect of thickness of anode functional layer on electrochemical performance of Ni–$Ce_{0.8}Gd_{0.2}O_{1.9}$ anode-supported solid oxide fuel cells

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ABSTRACT

A series of anode-supported cells with the dual-layer anode, composed of a porous anode supported layer with a composition of 60 wt% Ni + 40 wt% GDC (360 μm thick) and a denser anode functional layer (AFL) with a composition of 40 wt% Ni + 60 wt% GDC and different thicknesses adjacent to the GDC electrolyte, are developed to study the effect of the thickness of the AFL on the electrochemical performance of cells. For comparison, cells without the AFL are also prepared in the same manner. The study reveals that the AFL can improve the electrochemical performance of cells. However, the degree of improvement depends on the thickness of the AFL. The best improvement is achieved when the AFL thickness is not too large or too small, that is, the 60-mm AFL has the best electrochemical performance and displays a maximum power density of 41% higher than that of the cell without the AFL. These observations have been discussed based on the effects of the AFL on the anode–electrolyte interfacial contact resistance, the internal ohmic resistance, the triple-phase boundary length, and the concentration polarization resistance.

KEYWORDS: solid oxide fuel cells, anode-supported cells, anode functional layer, electrochemical performance