Optimization of Metallic Interconnectors for Clean Energy Power Systems

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Abstract

The increased energy demand and the need to reduce greenhouse gas (GHG) emissions have led to a significant increase in research and development of clean energy systems. Solid oxide fuel cells (SOFC) technology is a viable energy conversion system, which is engineered to utilize fuel such as hydrogen (H_2 gas) to yield usable electricity, producing water (H_2O) as the only byproduct during electrochemical reaction. SOFCs typically operate between the temperature range of 500-900C and generate electricity without the need for recharging so long as the fuel is supplied. A single SOFC cell consists of two porous electrodes, a dense electrolyte, and an interconnect (IC) that acts like a current collector on both electrodes. ICs are typically fabricated using chromia-forming alloys because they offer robust resistance to oxidation and corrosion as well as relatively high electrical conductivity. In this work, experimental research is conducted to understand the oxidation behavior of commercial IC alloys and its effect on the area-specific resistance (ASR) under systems operating conditions. Experimental details of measuring resistivity at high temperatures (~700C) will be discussed and the calculated time and temperature-dependent ASR will be presented. Implications of oxidation and corrosion of alloys at high temperatures under complex gas atmosphere and their effect on the electric conductive pathway will be discussed. Applications of this research pertaining to transportation, residential and commercial systems in energy storage and conversion technologies will be presented.