Effect of Sn Catalyst in Solid Fuel Mixture of Direct Carbon Fuel Cells

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Recently, direct carbon fuel cell (DCFC) is very attractive for the conversion of chemical to electrical energy and can utilize various carbon sources such as coal, coke, and even biomass. DCFC has relatively high conversion efficiency and releases only high-purity of carbon dioxide. Several concepts of DCFC have been demonstrated by applying solid oxide, molten carbonate, and molten hydroxide fuel cells. The use of solid oxide electrolyte has advantages of relatively higher reaction activity, avoiding degradation, corrosion, and leakage from liquid electrolyte, as well as more fuel flexibility due to its higher operation temperature (600-1000°C). However, previous studies still reported a major challenge for utilizing the direct carbon fuel since the oxidation of carbon at the interface between solid fuels to solid anode is limited. In this study, the role of Sn catalyst in a mixed fuel of direct carbon fuel cells (DCFCs) based on solid oxide fuel cell system is highlighted in terms of the enhanced solid-solid interface as well as intrinsic electro-catalytic activity. As a result, we observe four times higher power output (60.5 $mWcm^{-2}$) than of Sn-free fuel over 800°C.