Mechanical Engineering Thesis Defense

Fabrication of Solid Oxide Fuel Cells and the Effects of Varying the Anode Diameter on Cell Performance

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Abstract

Solid Oxide Fuel Cells (SOFCs) generate electricity using only hydrogen and oxygen and forming only H2O as the byproduct, giving them the potential to solve the impacts of global warming. In order to meet the power demands needed by society today, SOFCs need to significantly increase their power density. This study aims to look at decreasing the anode thickness in order to increase the mass transport of the fuel through the anode. Decreasing the thickness decreases the possibility of concentration overpotential which is caused when not enough of the reactants are able to reach the reaction site. There are few studies done directly looking at the correlation between mass transport and anode thickness for SOFCs. Experiments were performed in a split tube furnace heated to 750°C with a nickel-yttria-stabilized-zirconia (Ni-YSZ) supported cell. Pure hydrogen was supplied to the cell at rates of 10, 20, 30, and 40mL/min while the cathode was supplied air from the environment. The cell's performance was studied using the current-voltage method for creating polarization curves and electron impedance spectroscopy to create bode and nyquist plots. The cells did not display an increase in power density most likely due to errors in the cathode seeping into the buffer layer. The results from the electron impedance spectroscopy show a lower impedance for the frequencies pertaining to the gas diffusion at the anode for the thinner cells. This suggests that decreasing the anode thickness increases the mass transport of the gas.

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Zoom Link: https://asu.zoom.us/j/82245966163