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Tungsten oxide as a promising catalyst for ethanol reforming into SOFC

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In the present work, Solid Oxide Fuel Cells (SOFCs) were prepared using the following commercial materials: NiO and YSZ powders, CGO/Co and LSCF pastes, aiming to optimize the electrolyte and electrode films of the SOFC. For internal ethanol reforming at the anode of SOFCs, Tungsten oxide (WO_3) catalysts were tested in circular planar cells (50 mm in diameter and 0.4 mm thick) consisting oftwo cathode layers, one current collector (LSCF) and one functional layer (CGO-Co/LSCF), two electrolyte layers (YSZ and CGO-Co). Three anode layers, support anode, functional anode (Ni/YSZ) and catalytic anode (Ni/WO_3). The anode support is made of Ni/YSZ and all films were deposited by screen printing and sintered to a maximum of 1350°C. Physical-chemical characterization of the materials was conducted using BET analysis, X-ray diffraction, and scanning electron microscopy. The electrochemical performance of the SOFC was evaluated using electrochemical impedance spectroscopy (EIS) and linear sweep voltammetry. The cell withcatalyst, using hydrogen as fuel, showed low polarization resistance of 0.044 ohm×cm^{-2}, the current density of 0.55 A×cm^{-2}, and maximum power density of 270.5 mW×cm^{-2} were obtained. The SOFC with WO_3 – based catalyst showed polarization resistance of 0.14 ohm×cm^{-2}, current density of 0.65 A×cm^{-2}, and maximum power density of 258.6 mW×cm^{-2}, using a fuel mixture of 33% (v/v) ethanol in water fed directly to the anode at 740 ºC. The results indicate good electrochemical performance and promisingcatalytic activity of WO_3 for direct ethanol reforming. Performance could be further enhanced by optimizing film thickness and tungsten concentration in the anode.

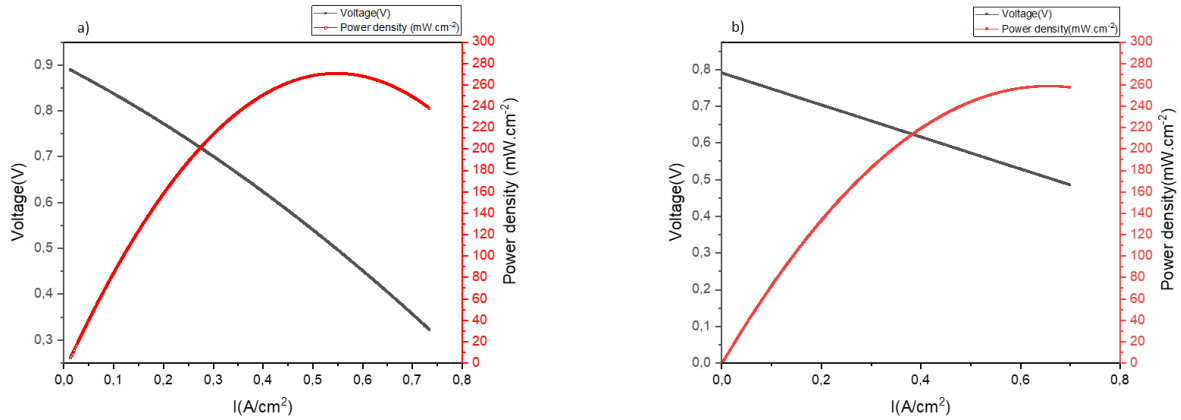

Figure 1 - Power density curves at 740ºC. (a) H_2 (200 mL / min), (b) C_2H_5OH (0.1 mL / min).

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