Solid Oxide Fuel Cells based on Lanthanum Tungstates Electrolytes

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Lanthanum tungstate with composition $La_{27}W_4NbO_{55-\delta}$ (LWNO) has been tested as proton conductor electrolyte for Solid Oxide Fuel Cells (SOFCs). For this purpose, different electrodes and composite electrodes are considered, including: $La_{0.8}Sr_{0.2}MnO_{3-\delta}$, $La_{0.6}Sr_{0.4}Co_{1-x}Fe_xO_{3-\delta}$, $La_{0.5}Sr_{0.5}Cr_{0.5}Mn_{0.5}O_{3-\delta}$, $SrFe_{0.75}Nb_{0.25}O_{3-\delta}$ and NiO. Chemical compatibility between the cell components is investigated by X-ray powder diffraction (XRPD) and energy dispersive spectroscopy (EDS). Furthermore, area specific resistance (ASR) of the different electrodes is determined in symmetrical cells by impedance spectroscopy. XRPD and EDS analysis do not reveal significant bulk reactivity between most of these electrodes and LWNO electrolyte in the typical operating temperature range of a SOFC (600-900 ºC). However, minor interdiffusion of elements at the electrolyte/electrode interface affects both the ohmic losses and electrode polarization of the cells. ASR values are significantly improved by using a buffer layer of $Ce_{0.8}Gd_{0.2}O_{1.9}$, between the electrolyte and electrode materials, to prevent reactivity. A single cell with 350 µm thick electrolyte, NiO-$Ce_{0.8}Gd_{0.2}O_{1.9}$ anode and $La_{0.6}Sr_{0.4}Co_{0.8}Fe_{0.2}O_{3-\delta}$ cathode, generates maximum power densities of 140 and 18 $mWcm^{-2}$ at 900 and 650 ºC, respectively.

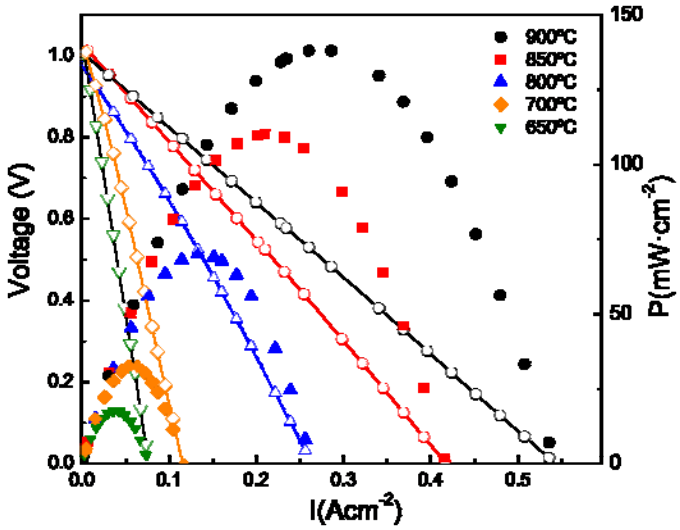

Figure 1. Cell voltage and power density as a function of current density at different temperatures using air and 5% H_2 –Ar as oxidant and fuel respectively**.**