Performance and stability of (ZrO2)0.89(Y2O3)0.01(Sc2O3)0.10-LaCr0.85Cu0.10Ni0.05O3-δ oxygen transport membranes under conditions relevant for oxy-fuel combustion

Self-standing, planar dual-phase oxygen transport membranes consisting of 70 vol.% (ZrO2)0.89(Y2O3)0.01(Sc2O3)0.10 (10Sc1YSZ) and 30 vol.% LaCr0.85Cu0.10Ni0.05O3-δ (LCCN) were successfully developed and tested. The stability of the composite membrane was studied in simulated oxy-fuel power plant flue-gas conditions (CO2, SO2, H2O). The analyses of the exposed composites by X-ray diffraction (XRD), X-ray fluorescence (XRF), attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR) and Raman spectroscopy revealed an excellent stability. Oxygen permeation fluxes were measured across 1000 μm thick and 110 μm thick self-supported 10Sc1YSZ-LCCN (70-30 vol.%) membranes from 700 °C to 950 °C using air as the feed gas and N2 or CO2 as the sweep gas. The 110 μm thick membrane, prepared by tape-casting and lamination processes, showed oxygen fluxes up to 1.02 mLN cm-2 min-1 (950 °C, air/N2). Both membranes demonstrated stable performances over long-term stability tests (250-300 h) performed at 850 °C using pure CO2 as the sweep gas.

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