Performance and stability of (ZrO$_2$)$_{0.89}$(Y$_2$O$_3$)$_{0.01}$(Sc$_2$O$_3$)$_{0.10}$-LaCr$_{0.85}$Cu$_{0.10}$Ni$_{0.05}$O$_{3-\delta}$ oxygen transport membranes under conditions relevant for oxy-fuel combustion

Self-standing, planar dual-phase oxygen transport membranes consisting of 70 vol.% (ZrO$_2$)$_{0.89}$(Y$_2$O$_3$)$_{0.01}$(Sc$_2$O$_3$)$_{0.10}$ (10Sc1YSZ) and 30 vol.% LaCr$_{0.85}$Cu$_{0.10}$Ni$_{0.05}$O$_{3-\delta}$ (LCCN) were successfully developed and tested. The stability of the composite membrane was studied in simulated oxy-fuel power plant flue-gas conditions (CO$_2$, SO$_2$, H$_2$O). 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 N$_2$ or CO$_2$ 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 CO$_2$ as the sweep gas.