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Yttrium doped BSCF membranes for oxygen separation

This work investigates the partial substitution of yttrium in place of iron in BSCF to form Ba$_{0.5}$Sr$_{0.5}$Co$_{0.8}$Fe$_{0.2-x}$Y$_x$O$_{3-\delta}$, where $x$ varied between 0 and 0.2. X-ray diffraction patterns showed the formation of a perovskite cubic phase structure up to $x = 0.15$, whilst the full substitution of yttrium ($x = 0.2$) for iron resulted in a non-cubic crystal structure that did not exhibit oxygen permeation. The yttrium partial substitution in BSCFY discs (1.2 mm thick) delivered best results for $x = 0.025$, as oxygen fluxes reached 2.05 ml cm$^{-2}$ min$^{-1}$ at 900 °C, an increase of 160% as compared to a blank BSCF ($x = 0$) membrane. This was attributed to the combined effect of the formation of a greater number of oxygen vacancies, together with improved ion mobility, associated with the beneficial yttrium substitution into the BSCF perovskite structure which stemmed from the crystal lattice expansion.