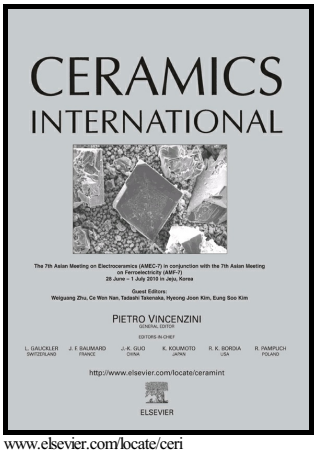

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CO_2-tolerance and oxygen permeability of novel cobalt-free mixed-conductor oxygen-permeable $Pr_{0.6}Sr_{0.4}Fe_{1-x}Nb_xO_{3-\delta}$ membranes

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Abstract

A series of novel cobalt-free dense oxygen-permeable membranes of the type with $Pr_{0.6}Sr_{0.4}Fe_{1-x}Nb_xO_{3-\delta}$ ($PSFN_x$, x=0–0.1) were synthesized. Subsequently, the effects of Nb-doping on the microstructure, oxygen permeability, and stability of $PSFN_x$ were studied under a pure He or CO_2 atmosphere. The structure of the material did not change in either atmospheres and its stability of the material was enhanced as the level of Nb-doping increased. For the sample with x=0 and 0.075, carbonates and sulfates were present on the sweep side of the PSF membrane, but no impurities were detected on the sweep side of the $PSFN_{0.075}$. In addition, the oxygen-permeation performance exhibited almost no attenuation when the Nb-doping content were 0.075. As revealed by X-ray photoelectron spectroscopy, the CO_2 resistance of the material was enhanced by reducing the basicity of $PSFN_x$, which was induced by the substitution of Fe with Nb.