

CO<sub>2</sub>-tolerance and oxygen permeability of novel cobalt-free mixed-conductor oxygen-permeable Pr<sub>0.6</sub>Sr<sub>0.4</sub>Fe<sub>1-x</sub>Nb<sub>x</sub>O<sub>3-δ</sub> membranes

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## Abstract

A series of novel cobalt-free dense oxygen-permeable membranes of the type with Pr<sub>0.6</sub>Sr<sub>0.4</sub>Fe<sub>1-x</sub>Nb<sub>x</sub>O<sub>3-δ</sub> (PSFN<sub>x</sub>,  $x=0-0.1$ ) were synthesized. Subsequently, the effects of Nb-doping on the microstructure, oxygen permeability, and stability of PSFN<sub>x</sub> were studied under a pure He or CO<sub>2</sub> 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<sub>0.075</sub>. 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<sub>2</sub> resistance of the material was enhanced by reducing the basicity of PSFN<sub>x</sub>, which was induced by the substitution of Fe with Nb.

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