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Controlling the Stress State of $La_{1-x}Sr_xCo_yFe_{1-y}O_{3-\delta}$ Oxygen Transport Membranes on Porous Metallic Supports Deposited by Plasma Spray-Physical Vapor Process.

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Abstract

$La_{0.58}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$ (LSCF), deposited on a metallic porous support by plasma spray-physical vapor deposition (PS-PVD) is a promising candidate for oxygen-permeation membranes. However, after O_2 permeation tests, membranes show vertical cracks leading to leakage during the tests. In the present work, one important feature leading to crack formation was identified. More specifically; Membrane residual stress changes during thermal loading were found to be related to a phase transformation in the support. In order to improve the performance of the membranes, the metallic support was optimized by applying an appropriate heat treatment. The observed oxygen fluxes during permeation tests had infinite selectivity and were amongst the highest fluxes ever measured for LSCF membranes in the thickness range of 30 μm, supported by LSCF porous substrates.

Keywords: Residual Stress, Oxygen transport membrane, Perovskite, Plasma Spray-Physical Vapor Deposition, O_2 permeation test.

1. Introduction