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Investigation on the phase stability of cubic perovskite $BaCo_{0.7}Fe_{0.2}Nb_{0.1}O_{3-\delta}$ oxygen-permeable membrane

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Abstract

The phase stability of the cubic perovskite-type oxide $BaCo_{0.7}Fe_{0.2}Nb_{0.1}O_{3-\delta}$ (BCFNO) has been examined by means of X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). And, the timescale on the second phases has been established by using the TOPAS 4.2. Compared with $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$(BSCFO), for samples annealed at T = 1023 K for t = 64 d, the rhombohedral and hexagonal phases formed on the surface of cubic perovskite BCFNO surface simultaneously and the amount of them is smaller. As for the rhombohedral phase, it comes out firstly along the grain boundary, and whose amount in equilibrium is about 5%. In contrast to the rhombohedral phase, the hexagonal phase is more likely to form at lower temperature which lead to the microcracks. In brief, obtaining the eligible phase stability is crucial for the industrial application of the oxygen permeation membrane.

Keywords: phase stability, rhombohedral phase, hexagonal phase, evolution mechanism

1. Introduction

Perovskite oxides with high oxygen conductivity belong to the common mixed ionic and electronic conductors (MIECs), which are usually employed as cathodes in solid-oxide fuel cells and as membranes for oxygen separation [1-3]. The working principle of MIECs is that oxygen ions and