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Hydrogen Production from water splitting using $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (BSCF) membrane coated with $BaCe_{0.2}Fe_{0.8}O_{3-\delta}$

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Abstract

$Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (BSCF) membrane can be very effective in hydrogen production from high-temperature water splitting by the in-situ permeation of oxygen through the membrane. However, the BSCF membrane cannot initiate the water splitting reaction at moderate temperature (750-950oC); hence a catalyst is required. Herein, we have developed and evaluated a new BaCexFe1-xO3-δ catalyst. The concentration of cerium was varied to determine its effect on the cubic structure. XRD results confirmed the cubic structure was maintained up to 20 mol% of cerium. The BaCe0.2Fe0.8O3-δ powder was coated as a catalyst on the BSCF membrane and evaluated for hydrogen production in a water-splitting membrane reactor. The obtained results revealed that hydrogen production rate increases with increasing temperature, methane concentration in the sweep gas, and water concentration in the feed gas. The highest hydrogen production rate (0.38µmol/cm^{2}s) was obtained at 925oC using 15% CH_4 in the sweep and 55% H_2O in the feed.

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