

Improvement of catalytic stability of BaCo/CeO₂ catalyst by controlling the loading amount of Ba promoter for high temperature water-gas shift reaction using waste-derived syngas

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The loading amount of Ba promoter has controlled from 0 wt.% to 3 wt.% in 15 wt.% Co/CeO₂ catalyst system and applied to the high temperature water-gas shift reaction using waste-derived synthesis gas. The catalysts are prepared by the incipient wetness co-impregnation method and characterized through various techniques such as X-ray diffraction, Brunauer-Emmet-Teller measurements, CO-chemisorption, H₂-temperature programmed reduction, X-ray photoelectron spectroscopy, and transmission electron microscopy. Doping of proper amount (1-2 wt.%) of Ba promoter improves the reducibility of the catalyst and enhances the sintering resistance. However, doping of excess amount (≥ 3 wt.%) weakens the reducibility of the catalyst, resulting to the instability of the active phase (Co⁰). Overall, 1% BaCo/CeO₂ catalyst shows the best catalytic performance even at a very high gas hourly space velocity of 143,000 h⁻¹ due to the strong resistance to the sintering and high stability of the Co⁰.