Effect of preparation method on Co-CeO_2 catalysts for high temperature water-gas shift reaction using waste derived synthesis gas

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To enhance the catalytic performance of Co-CeO_2 catalyst, we prepared Co-CeO_2 catalysts using different synthetic methods to investigate the effect of preparation method on physicochemical characteristics and to optimize the preparation method of the Co-based catalysts in the high-temperature water-gas shift (WGS) reaction. We applied incipient wetness impregnation method (IWI), co-precipitation method (CP), hydrothermal method (HT), and sol-gel method (SG) to the Co-CeO_2 catalysts for WGS reaction using waste derived synthesis gas. In conclusion, Co-CeO_2 (SG) catalyst exhibited the excellent catalytic performance, even in the severe conditions (high CO concentration: ~38% in dry basis and high gas hourly space velocity: 142,689 h^{-1}). H_2-Temperature Programmed Reduction (H_2-TPR) result show that preparing the Co-CeO_2 catalyst by sol-gel method improves the interaction between Co metal and CeO_2 support. Raman spectroscopy was used to measure the concentration of oxygen vacancies, and Co-CeO_2 (SG) catalyst showed the oxygen vacancies compared to other catalysts.