

Metal-support interaction in Ni/CeO₂-ZrO₂-Al₂O₃ catalysts and its influence on hydrogen production from ethanol steam reforming

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In this study, Ni/CeO₂-ZrO₂-Al₂O₃ (CZA) catalysts with different Ni contents and CZ to Al₂O₃ ratio were prepared by a solvent hydrothermal method for CZA support and a subsequent impregnation of different Ni amounts into the supports to investigate the metal-support interaction in the catalyst system and catalytic performance. Characterization of catalysts by H₂-TPR, NH₃-TPD, XRD, XPS, Raman, and N₂ adsorption-desorption technique revealed changes in the metal-support interaction, acidity and oxygen vacancy with different Ni and CZ content. XRD results showed the main phases of the supported catalysts include the Ni phase, which played an important role in the activity of the catalyst performance, and the interaction between Ni and the carrier affected the selectivity of the catalyst. The addition of Ni enhanced the H₂ selectivity and decreases liquid products. Larger CZ ratio created a greater number of oxygen vacancies which were beneficial to prevent the formation of carbon due to the oxygen storage capacity presented by CeO₂. Moreover, the interaction between Ni and metal oxide supports resulted in more facile reduction of surface CeO₂ and also could stabilize the CZ phase.