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Steam Reforming of Acetic Acid over Microwave-Synthesized Ce0.75Zr0.25O2 Supported Ni Catalysts

Authors : Panumard Kaewmora, Thirasak Rirksomboon, Vissanu Meeyoo

Abstract : Due to the globally growing demands of petroleum fuel and fossil fuels, the scarcity or even depletion of fossil fuel sources could be inevitable. Alternatively, the utilization of renewable sources, such as biomass, has become attractive to the community. Biomass can be converted into bio-oil by fast pyrolysis. In water phase of bio-oil, acetic acid which is one of its main components can be converted to hydrogen with high selectivity over effective catalysts in steam reforming process. Steam reforming of acetic acid as model compound has been intensively investigated for hydrogen production using various metal oxide supported nickel catalysts and yet they seem to be rapidly deactivated depending on the support utilized. A catalyst support such as Ce1-xZrxO2 mixed oxide was proposed for alleviating this problem with the anticipation of enhancing hydrogen yield. However, catalyst preparation methods play a significant role in catalytic activity and performance of the catalysts. In this work, Ce0.75Zr0.25O2 mixed oxide solid solution support was prepared by urea hydrolysis using microwave as heat source. After that nickel metal was incorporated at 15 wt% by incipient wetness impregnation method. The catalysts were characterized by several techniques including BET, XRD, H2-TPR, XRF, SEM, and TEM as well as tested for the steam reforming of acetic acid at various operating conditions. Preliminary results showed that a hydrogen yield of ca. 32% with a relatively high acetic conversion was attained at 650°C.

Keywords : acetic acid, steam reforming, microwave, nickel, ceria, zirconia
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