Effect of Sn modification on Ni catalyst for deoxygenation of stearic acid

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Deoxygenation of fatty acid molecules has been employed as one of promising processes for highly efficient production of renewable diesel. In addition, non-noble metal catalysts e.g. Ni, Co, Cu have become attractive as an alternative low cost material group and to avoid sulfur contamination in fuel product compared with the conventional $NiMoS_2$ and $CoMoS_2$ catalysts. In this work, the Ni/γ-Al_2O_3 and NiSn/γ-Al_2O_3 catalysts were prepared by wetness impregnation method and characterized by various techniques including X-ray diffraction (XRD), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), N_2 adsorption-desorption, and Temperature programmed reduction of hydrogen (H_2-TPR). The deoxygenation activity was investigated by a Parr batch reactor (300 mL in size) at 300^{o}C for 1-6 h under H_2 pressurization. The decarboxylation (DCO_2) and decarbonylation (DCO) of stearic acid to produce heptadecane ($C_{17}H_{36}$) were proposed as the main pathways over the use of NiSn catalysts, whereas the hydrodeoxygenation (HDO) became a minor reaction confirmed by the high ratio of C17:C18 alkanes. Moreover, the Sn doping in Ni catalyst apparently affected the stearic acid conversion and selectivity of hydrocarbon products.

Keywords: Deoxygenation, stearic acid, Ni/γ-Al_2O_3 catalysts, NiSn/γ-Al_2O_3 catalysts