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Alumina-carbon nanofiber composite as a support for MoCo catalysts in hydrodesulfurization reactions

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Abstract

Developing more effective catalysts for the hydrodesulfurization (HDS) process has gained more importance in recent decades to produce ultraclean fuel. In the current study, a novel carbon nanofiber doped alumina (AlCNF) was prepared as a support for the MoCo catalyst for the HDS reaction of dibenzothiophene (DBT). The in-situ prepared composites were characterized by using Brunauer–Emmett–Teller (BET), temperature-programmed reduction (TPR) powder X-ray diffraction (XRD), scanning electron microscope (SEM), infrared spectroscopy (FT-IR), and thermogravimetric analysis (TGA). The catalytic activity of the MoCo catalysts supported on nanofiber doped alumina (AlCNFMoCo) was tested and compared with the MoCo catalysts supported on alumina (AlMoCo). The AlCNFMoCo catalyst reduced the sulfur concentration in the liquid fuel down to below the allowed limit in a 6h reaction time, showing a higher catalytic activity compared to AlMoCo. The improved catalytic activity of AlCNFMoCo can be explained by the high mesoporous surface area and the better dispersion of the MoCo metals on the AlCNF support compared to the alumina support. BET analysis indicated that the textural properties were improved by introducing CNF. The surface areas of AlMoCo and AlCNFMoCo were 166