

NiK/CeZr-Al catalysts for steam catalytic cracking of vacuum residue

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The effect of Ce_yZr_{1-y}O₂ addition ($0 < y < 1$) on the NiK/xCeZr-Al catalysts, where x was the weight percentage of (Ce + Zr) and calculated as $[\text{mass of (Ce + Zr)}] \times 100 / [\text{mass of (Ce + Zr + Al}_2\text{O}_3)]$, for steam catalytic cracking (SCC) of vacuum residue (VR) have been investigated by reaction tests using a fixed bed reactor at 500 °C, atmospheric pressure and some physicochemical characterizations like XRD, BET, TEM, XPS and TPO. The reaction test results show that the Ce_yZr_{1-y}O₂ addition could greatly improve the catalytic performance of the NiK/y-Al₂O₃. The total yield of liquid plus gaseous products increases with increasing H/C ratio. From the X-ray diffraction analysis, it was considered that the active oxygen species generated from water over zirconia particles spilled over the cerium oxide surface, where the oxidized decomposition of heavy oil occurred. The remaining active hydrogen species from water decomposition are then added to the lighter molecules on nickel active phases, resulting in the increasing H/C ratio of the liquid product.