

Catalyst Evaluation and Scale-up studies of Environmentally friendly Fe-Al-Cu catalysts for HT-WGS reaction

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We synthesized a homogeneous co-precipitation method to scale up the Cr-free Fe-Al-Cu catalyst (FAC) previously prepared on a laboratory scale and exhibiting excellent performance in the high temperature water gas shift (HT-WGS) reaction. The physicochemical properties of catalysts prepared on both laboratory and large scales were examined by BET, XRD, and H₂-TPR. Among the prepared catalysts, FAC-PC-1 (Fe: 0.042 M, Al: 0.005 M, and Cu: 0.005 M) and FAC-PC-3 (Fe: 0.126 M, Al: 0.015 M, and Cu: 0.015 M) achieved higher CO conversions in the WGS reaction than other catalysts and did not promote undesirable side reactions. The above catalysts were compared with each other and with the commercial Fe-Cr catalyst in terms of laboratory-scale HT-WGS reaction performance. The performance of the FAC-PC-3-240 catalyst synthesized by controlling precursor concentration successfully proved the possibility of Cr substitution and demonstrated the excellent ability of this catalyst to promote the conversion of waste-derived synthesis gas into H₂.