SYNTHESIS AND CHARACTERIAZTION OF PROMOTED FE_3O_4 CATALYSTS FOR CO_2 REDUCTION

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Abstract

Anthropogenic carbon dioxide (CO_2) released into the atmosphere can both be considered a wasted raw material and a greenhouse gas. CO_2 is very stable, which means it accumulates in the atmosphere. It can be chemically converted, making it a useful raw material for the chemical industry. One such solution is the reaction of carbon dioxide with hydrogen, which produces carbon monoxide and methane, as well as liquid hydrocarbons. Due to the stability of CO_2, we must utilise catalysts to activate it chemically. Iron-based catalysts, which have been modified to have high carbon dioxide conversion and good selectivity, can provide an effective and inexpensive solution.

Our research group has previously demonstrated in publications that modified iron oxide catalysts are well suited for CO_2 hydrogenation reactions [1,2]. In this study, we characterized mixed iron oxide catalysts impregnated with various metals (K, Mg, Mn, Na, Zn) and examined their catalytic performance. The prepared samples were characterized using XRD, TEM, H_2-TPR, and CO_2-TPD technologies. The reaction was carried out in a high-pressure (30 bar) tubular reactor. Gas chromatography was used to analyze the products of the catalytic reactions. The K-Fe_3O_4 sample gave the highest CO_2 conversion value (40.03%) and the highest C_{5+} hydrocarbon selectivity (36.61%), while the Zn-Fe_3O_4 sample had the lowest CO selectivity (2.01%). *In situ* DRIFTS measurements showed, that in case of all five catalasysts the reaction pathway were identical. *'Quasi' in situ* XPS was utilised in order to gain insight regarding the oxidation states of the surface metals. The samples were measured in pretreated state and after reaction. Following reduction all samples showed to consist of metallic iron. After reaction the composition of surface metals were dependant on the promoter used [3,4].

References

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