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A study of the catalytic properties of mesoporous silica doped with dysprosium and modified with copper on the example of xylene hydrogenation

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Abstract

Catalytic hydrogenation of aromatic hydrocarbons is one of the most important reactions in industry. The use of copper as a modifier of silica is beneficial both from an economic point of view and from the point of view of ease of modification. The catalytic properties of a mesoporous structured material modified by copper (Cu/MCM) and a mesoporous structured material (MCM) doped with dysprosium and modified copper (Dy-Cu/MCM) synthesized by the template method were studied in xylene hydrogenation reactions. The textural characteristics of the catalysts obtained were studied by low-temperature nitrogen adsorption-desorption, ICP, XRF, XRD, SEM, TEM. To determine the specific surface area, the BET model was used with a relative partial pressure P/P_0 0.05-0.3. The total pore volume and size distribution of meso- and macroporous was calculated from the desorption curve using the BJH model. With the help of the ICP-method, the metals were also quantitatively determined using the absolute calibration method. For the analysis of microporous, the DFT density functional method was used. The study of the kinetics of hydrogenation of *o, m, p*-xylenes was carried out in the temperature range 130-170 °C and a hydrogen pressure of 3 atm. The kinetics of gas-phase hydrogenation reactions was studied in a static mode using the method of gas chromatography, on the original setup, which allows *on-line* analysis of the reaction mixture. The xylene conversions on Cu/MCM and Dy-Cu/MCM catalysts are calculated at various reaction temperatures.

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