

La₂O₃/γ-Al₂O₃催化剂用于二甲醚二氧化碳重整制氢

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CO₂ reforming of dimethyl ether to produce hydrogen over La₂O₃/γ-Al₂O₃ catalyst

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摘要 采用等体积浸渍法制备了不同负载量的La₂O₃/γ-Al₂O₃催化剂,并考察了负载量和反应温度对催化剂用于二甲醚二氧化碳重整制氢反应的性能影响。结果表明,反应温度为550℃、La₂O₃负载量为15%时,催化剂表现出最好的性能:二甲醚的转化率为100%,二氧化碳的转化率达到85.4%,产物氢气的选择性高达93.3%,一氧化碳的选择性为76.04%,副产物甲烷的选择性仅为6.3%。550℃时其平均积炭速率为1.387 5 mg/(g·h)。研究还利用XRD、BET、TEM、TG等方法对催化剂进行了表征。

关键词: 二甲醚 二氧化碳重整 氧化镧 氧化铝 氢气

Abstract: In this paper, La₂O₃/γ-Al₂O₃ catalysts with different La loading were prepared by incipient wetness impregnation method. This paper investigated the influence of La loading and reaction temperature on catalytic performance for the carbon dioxide reforming of DME. The catalysts were characterized by X-ray diffraction (XRD), BET surface area, transmission electron microscopy (TEM), thermogravimetry and differential thermal analysis (TG-DTA). The results showed that the La₂O₃/γ-Al₂O₃ with 15% La loading gave the best catalytic performance at 550 °C. The selectivity of H₂ and CO were 93.3% and 76.04%, and the conversion of CO₂ and DME were about 85.4% and 100%, respectively, while the selectivity of byproduct CH₄ is only 6.3%. This 15% La₂O₃/γ-Al₂O₃ catalysts had more symmetrical distribution of particle size, larger specific surface area and more proper pore structure, and it kept stable performance during 4 h test. As a result, the catalyst average coking rate was only about 1.387 5 mg/(g·h).

Key words: dimethyl ether carbon dioxide reforming lanthanum oxide alumina hydrogen

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