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研究论文

$SO_3/\gamma\text{-}Al_2O_3$固体酸催化剂的制备、结构与酸性表征

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摘要 用酸中和法制备了活性$\gamma\text{-}Al_2O_3$, 并在其表面负载SO_3得到固体酸催化剂$SO_3/\gamma\text{-}Al_2O_3$, 用XRD, TG-DTA, FT-IR，NMR, NH_3-TPD等对其进行了结构和酸性研究. 结果表明: 在$SO_3/\gamma\text{-}Al_2O_3$的制备过程中形成少量的$Al_2(SO_4)_3$, 同时$SO_3$与$\gamma\text{-}Al_2O_3$表面上的羟基反应, 形成强的Brönsted酸位, 根据$^1H/^{27}Al$ 双共振(TRAPDOR)MAS NMR与FT-IR实验结果提出了Brönsted酸结构模型. $SO_3/\gamma\text{-}Al_2O_3$表面存在两种不同强度的酸中心, 其酸强度大于分子筛HZSM-5, 但弱于传统的固体超强酸 /$\gamma\text{-}Al_2O_3$.

关键词 $SO_3/\gamma\text{-}Al_2O_3$. 固体酸催化剂 固体NMR 酸位结构

分类号

Preparation of $SO_3/\gamma\text{-}Al_2O_3$ Solid Acid Catalyst and Characterization of Its Structure and Acidity

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Abstract A solid acid catalyst $SO_3/\gamma\text{-}Al_2O_3$ was prepared by adsorption of SO_3 gas onto the surfaces of activated $\gamma\text{-}Al_2O_3$. The structure and acidity of the catalyst were studied by XRD, NMR, FT-IR, TG-DTA and NH_3-TPD method. The results indicated that SO_3 reacted with activated $\gamma\text{-}Al_2O_3$ to form a small quantity of $Al_2(SO_4)_3$, and at the same time, the adsorption of SO_3 on the surface of $\gamma\text{-}Al_2O_3$ introduced two different kinds of Brönsted acid sites, which can be attributed to two different acid hydroxyl groups, including the bridging hydroxyl groups (S-OH-Al, giving rise to an ^1H resonance at *ca*. δ 4.3) and the terminal hydroxyl groups attached to S atoms (S-OH, giving rise to an ^1H resonance at *ca*. δ 11.2). The structure of Brönsted acid sites on the surface of catalyst $SO_3/\gamma\text{-}Al_2O_3$ has been proposed based on $^1H/^{27}Al$ TRAPDOR and FT-IR results. The acid strength of $SO_3/\gamma\text{-}Al_2O_3$ is stronger than that of zeolite HZSM-5, but still weaker than that of /$\gamma\text{-}Al_2O_3$, which is a conventional solid superacid catalyst.

Key words $SO_3/\gamma\text{-}Al_2O_3$. solid acid catalyst solid-state NMR acid site structure

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