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研究论文

碱土金属氧化物对丙三醇和苯胺气相合成 3-甲基吲哚的 Cu/SiO_2-Al_2O_3 催化剂的作用

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- 摘要
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摘要 研究了碱土金属氧化物的添加对丙三醇和苯胺气相合成 3-甲基吲哚的 Cu/SiO_2-Al_2O_3 催化剂性能的影响, 采用 X 射线衍射、透射电镜、H_2 程序升温还原、NH_3 程序升温脱附以及热重-差热等技术对催化剂进行了表征. 结果表明, MgO 能加强活性组分和载体之间的相互作用, 从而促进铜粒子在载体上的分散. 另外, MgO 能增加弱酸中心数, 并且抑制积炭的形成, 因而 Cu-MgO/SiO_2-Al_2O_3 催化剂性能大大提高; 而 CaO, SrO 或 BaO 的加入不利于 Cu/SiO_2-Al_2O_3 催化剂上 3-甲基吲哚的生成. 这是由于铜粒子在载体上的分散度变差, 而且在 Cu-SrO/SiO_2-Al_2O_3 及 Cu-BaO/SiO_2-Al_2O_3 催化剂上弱酸中心数较少. 碱土金属氧化物的加入不能改变催化剂上积炭的结构.

关键词:

Abstract: The effect of the addition of an alkaline-earth metal oxide (MgO, CaO, SrO or BaO) to a Cu/SiO_2-Al_2O_3 catalyst for the vapor-phase synthesis of 3-methylindole from glycerol and aniline was investigated. The catalysts were characterized by X-ray diffraction, transmission electron microscopy, H_2 temperature-programmed reduction, NH_3 temperature-programmed desorption, and thermogravimetric and differential thermal analysis. MgO reinforced the interaction between copper and the support, which promoted the dispersion of Cu particles. In addition, MgO increased the amount of weak acid sites and inhibited the formation of coke. As a result, the addition of MgO to Cu/SiO_2-Al_2O_3 gave a much improved catalyst. Adding CaO, SrO or BaO to Cu/SiO_2-Al_2O_3 deteriorated the catalysts because the dispersion of Cu particles became worse and the amounts of weak acid sites on Cu-SrO/SiO_2-Al_2O_3 and Cu-BaO/SiO_2-Al_2O_3 were fewer. The addition of the alkaline-earth metal oxides did not change the texture of the coke formed.

Keywords: copper, silica, aluminum oxide, alkaline-earth metal oxides, 3-methylindole, glycerol, aniline

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