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多级孔ZSM-5分子筛的制备及催化噻吩烷基化性能研究

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Preparation of hierarchical ZSM-5 zeolites and their catalytic performance in thiophene alkylation

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摘要 用不同浓度的 Na_2CO_3 溶液处理ZSM-5分子筛,采用XRD、XRF、SEM、 N_2 吸附脱附及 NH_3 -TPD方法对处理前后的ZSM-5分子筛进行表征,并考察了 Na_2CO_3 溶液处理对ZSM-5分子筛孔结构、酸性以及噻吩烷基化性能的影响。结果表明, Na_2CO_3 溶液处理在保持ZSM-5分子筛微孔骨架结构的同时,增加了ZSM-5分子筛的比表面积、外表面积和介孔体积,并调变了酸性。 Na_2CO_3 溶液处理提高了ZSM-5分子筛催化剂的噻吩烷基化活性和噻吩选择性。一定反应条件下,随着 Na_2CO_3 溶液浓度增加,多级孔ZSM-5分子筛的噻吩烷基化性能逐渐提高,而噻吩选择性先增加后下降。当 Na_2CO_3 溶液浓度为2 mol/L时,分子筛的噻吩转化率和噻吩选择性分别为81.26%和73.15%。当 Na_2CO_3 溶液浓度为3 mol/L时,噻吩转化率和选择性分别为90.57%和72.59%。

关键词: 碱处理 Na_2CO_3 ZSM-5 噻吩 烷基化

Abstract: ZSM-5 zeolites were treated by Na_2CO_3 solutions with different concentrations and characterized by XRD, XRF, SEM, N_2 sorption and NH_3 -TPD techniques; the influence of Na_2CO_3 treatment on their pore structure, acidity and performance in thiophene alkylation was investigated. The results showed that the BET surface area, external surface area and mesoporous volume of the ZSM-5 zeolites were enhanced through Na_2CO_3 treatment and the acidity was also modulated without altering the microporous structure of ZSM-5 zeolites. The activity and the selectivity to alkylates of the ZSM-5 zeolites in thiophene alkylation are also improved after Na_2CO_3 treatment. With the increase of Na_2CO_3 solution concentration, the thiophene conversion over the hierarchical ZSM-5 zeolites increases gradually, while the selectivity to alkylates increases first, reaches a maximum and then decreases along with the Na_2CO_3 solution concentration. When the Na_2CO_3 concentrations are 2 and 3 mol/L the thiophene conversions and alkylation selectivities are 81.26%, 73.15% and 90.57%, 72.59%, respectively.

Key words: alkali-treatment Na_2CO_3 ZSM-5 thiophene alkylation

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