

研究论文

# 磷酸修饰MCM-49分子筛的结构、酸性及苯与丙烯液相烷基化反应催化性能

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**摘要** 在10 L反应釜中用动态水热法合成了MCM-49分子筛, 采用浸渍方法制备了磷酸修饰MCM-49分子筛, 并用XRD, 氮气吸附-脱附, NH<sub>3</sub>-TPD, FTIR和<sup>27</sup>Al MAS-NMR等方法进行了表征. 考察了磷酸修饰MCM-49分子筛在苯与丙烯液相烷基化反应中的催化性能. NH<sub>3</sub>-TPD和FTIR表征结果说明, 磷酸修饰处理使MCM-49分子筛的Brønsted酸和Lewis酸的酸量降低, 强酸中心酸量略有降低. <sup>27</sup>Al MAS-NMR结果表明磷酸修饰使MCM-49分子筛骨架部分脱铝, 脱除的铝与磷酸作用生成了磷铝酸盐. 在实验条件下, MCM-49分子筛的丙烯转化率为9.6%, 异丙苯选择性为75.3%. 磷酸修饰处理提高了苯与丙烯液相烷基化反应产物中异丙苯的选择性. 磷负载质量分数为2.0%的MCM-49的丙烯转化率和烷基化产物的总选择性(包括异丙苯、二异丙苯和三异丙苯)与MCM-49相当, 而异丙苯的选择性提高了7.2%.

**关键词** [MCM-49分子筛](#) [苯和丙烯烷基化](#) [磷酸](#)

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## Structure and Acid Properties of Phosphate-modified MCM-49 Zeolites and Their Catalysis Performance for the Alkylation of Benzene with Propylene in Liquid

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**Abstract** MCM-49 zeolite was synthesized hydrothermally in a 10 L autoclave by dynamic method. The phosphate-modified MCM-49 zeolites were prepared by impregnation. The resulting solids were characterized by different techniques, such as XRD, N<sub>2</sub> adsorption-desorption, NH<sub>3</sub>-TPD, FTIR and <sup>27</sup>Al NMR. Benzene alkylation with propylene was carried out by using MCM-49 and phosphate-loaded MCM-49 zeolite as the catalysts. Both the amounts of Brønsted and Lewis acid on phosphate-modified MCM-49 were decreased. <sup>27</sup>Al NMR spectrum reveals that the loading of phosphate onto MCM-49 results in an increase of the amounts of extraframework aluminum, and two new signals corresponding to Al(OP)<sub>6</sub> and Al(PO)<sub>4</sub> can be found, respectively. Loading of phosphate onto MCM-49 greatly enhances the selectivity to IPB in benzene alkylation with propylene. The phosphate-modified MCM-49 catalyst containing 2.0% (mass fractio

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n) phosphorus, at a reaction temperature of 140 °C, exhibits 81.1% selectivity to IPB and 97.2% selectivity to all alkylation products (including IPB, DIPBs and TIPB) with a similar conversion of propylene in comparison with MCM-49.

**Key words** [MCM-49 zeolite](#) [Alkylation benzene with propylene](#) [Phosphorus acid](#)

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