

## 无模板剂条件下 ZSM-5 与丝光沸石之间的可控转晶

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**摘要** 采用预晶化液添加法, 即将高温 (190 °C) 预晶化液添加到低温 (150 °C) 晶化母液中合成沸石分子筛, 考察了高温预晶化液的 Na<sub>2</sub>O:SiO<sub>2</sub> 比、预晶化时间以及低温晶化母液的 Na<sub>2</sub>O:SiO<sub>2</sub> 比对 ZSM-5 与丝光沸石之间转晶的影响, 并采用 X 射线衍射和扫描电子显微镜对合成的产物进行了表征. 研究发现, 通过调节整体合成液的 Na<sub>2</sub>O:SiO<sub>2</sub> 比可有效控制 ZSM-5 沸石与丝光沸石之间的转晶. 当整体合成液的组成为 xNa<sub>2</sub>O:100SiO<sub>2</sub>:2.5Al<sub>2</sub>O<sub>3</sub>:12SO<sub>4</sub><sup>2-</sup>:4000H<sub>2</sub>O 时, Na<sub>2</sub>O:SiO<sub>2</sub> = 0.18 是 ZSM-5 沸石和丝光沸石的一个分界线. 通过调节母液的 Na 含量, 使 Na<sub>2</sub>O:SiO<sub>2</sub> > 0.18 时, 高温预晶化过程中产生 MFI 结构的晶体在低温晶化时可向丝光沸石发生转晶; 当 Na<sub>2</sub>O:SiO<sub>2</sub> ≤ 0.18 时, 具有 MFI 和丝光沸石结构共生的晶体在低温晶化时向 MFI 结构的 ZSM-5 沸石发生转晶. ZSM-5 与丝光沸石之间转晶的前提条件是高温预晶化所形成晶体的结晶度不能太高 (≤ 30%). 另外, 整体合成液中 Na<sub>2</sub>O 含量对生成晶体的形貌也有影响.

**关键词:** ZSM-5 沸石 无模板剂 丝光沸石 转晶 控制

**Abstract:** Zeolite crystals were synthesized at a lower temperature (150 °C) by adding a nucleation solution prepared at higher temperature (190 °C) to the mother solution. The effects of the Na<sub>2</sub>O/SiO<sub>2</sub> ratio, nucleation time of the nucleation solution, and the ratio of Na<sub>2</sub>O/SiO<sub>2</sub> ratio in the mother solution on crystal transformation between ZSM-5 and mordenite were investigated. The transformation between zeolite ZSM-5 and mordenite could be controlled effectively by changing the overall Na<sub>2</sub>O/SiO<sub>2</sub> ratio in the overall solution. A Na<sub>2</sub>O/SiO<sub>2</sub> ratio of 0.18 formed a boundary between ZSM-5 and mordenite phases when the overall solution had a composition of xNa<sub>2</sub>O:100SiO<sub>2</sub>:2.5Al<sub>2</sub>O<sub>3</sub>:12SO<sub>4</sub><sup>2-</sup>:4000H<sub>2</sub>O. When the Na<sub>2</sub>O/SiO<sub>2</sub> ratio was increased higher than 0.18 by altering the composition of the mother solution, the ZSM-5 product formed by nucleation at higher temperature (190 °C) could be transformed into mordenite crystals during crystallization at lower temperature (150 °C). When the Na<sub>2</sub>O/SiO<sub>2</sub> ratio was ≤ 0.18, a product containing both ZSM-5 and mordenite crystals was obtained during nucleation at higher temperature that could be transformed into ZSM-5 crystals during crystallization at lower temperature. A precondition for crystal transformation between ZSM-5 and mordenite was that the crystallinity of the product formed during nucleation at higher temperature must be ≤ 30%.

**Keywords:** ZSM-5 zeolite, template-free, mordenite, crystal transformation, controlling

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