

## 短孔道 Cu-Mn/Zr-Ce-SBA-15 催化剂的制备及其催化甲苯燃烧性能

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**摘要** 采用水热法制备了 Zr-Ce-SBA-15(ZCS) 介孔材料, 并以它为载体, 通过浸渍法制备了不同 Cu/Mn 比和 Cu-Mn 含量的 Cu-Mn/ZCS 催化剂. 采用 N<sub>2</sub> 吸附-脱附、透射电镜、扫描电镜、X 射线衍射和 X 射线光电子能谱 (XPS) 等手段对催化剂进行了表征, 并在微型固定床反应器上评价了催化剂催化甲苯燃烧性能. 结果表明, Cu-Mn/ZCS 催化剂具有六方板状形貌和高度有序的短孔道介孔结构 (孔道长 0.4~0.5 μm). 20%Cu-Mn/ZCS 催化剂的比表面积、孔体积和孔径分别为 296 m<sup>2</sup>/g, 0.42 cm<sup>3</sup>/g 和 6.4 nm. 与长孔道的 20%Cu-Mn/SBA-15 催化剂 (孔道长 1~2 μm) 相比, 20%Cu-Mn/ZCS 催化剂上甲苯燃烧反应的 T<sub>95</sub> (转化率达 95% 以上的反应温度) 从 284 °C 降至 270 °C, 表明短孔道 Cu-Mn/ZCS 催化剂具有更高的催化活性.

**关键词:** 短孔道 铜 锰 钴 铈 SBA-15 分子筛 甲苯 催化燃烧

**Abstract:** The mesoporous Zr-Ce-SBA-15 (ZCS) material with short mesochannels was synthesized through a hydrothermal route. A series of Cu-Mn/ZCS catalyst samples with different Cu/Mn ratios and Cu-Mn contents were prepared by impregnation. The structure of the catalyst samples was characterized by N<sub>2</sub> adsorption-desorption, transmission electron microscopy, scanning electron microscopy, X-ray diffraction, and X-ray photoelectron spectroscopy. The catalytic performance of the catalyst for toluene combustion was evaluated in a fixed-bed microreactor. The results reveal that the Cu-Mn/ZCS catalyst has unique hexagonal platelet morphology and possesses highly ordered two-dimensional hexagonal mesoporous structure with short channels (0.4 - 0.5 μm). The specific surface area, pore volume, and pore diameter of the 20%Cu-Mn/ZCS are 296 m<sup>2</sup>/g, 0.42 cm<sup>3</sup>/g, and 6.4 nm, respectively. Compared with 20%Cu-Mn/SBA-15 with longer channel length (1 - 2 μm), the temperature of 95% toluene conversion (T<sub>95</sub>) over 20%Cu-Mn/ZCS decreases from 284 to 270 °C, indicating that the short channeled Cu-Mn/ZCS catalyst possesses higher catalytic activity than that over Cu-Mn/SBA-15.

**Keywords:** short mesochannel, copper, manganese, zirconium, cerium, SBA-15 zeolite, toluene, catalytic combustion

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