

大孔FCC催化剂的制备及裂化性能研究

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Preparation of macroporous catalysts and their performance in catalytic cracking of heavy oil

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摘要 利用聚苯乙烯(PS)颗粒和脱油残渣(VR)乳液为模板剂制备了大孔重油催化裂化催化剂,与未加模板的参比催化剂相比,比表面积分别增加了38.0%和46.2%,孔体积分别增加了20.6%和35.8%,平均孔径分别增加了54.5%和27.3%。微反评价结果表明,大孔催化剂活性较高,对重油的转化率分别提高了9.8%和12.2%,总液收分别提高了10.2%和7.3%。与参比催化剂相比,积炭后PS颗粒和VR乳液模板大孔催化剂的活性有一定程度的降低,但是当积炭量相同时,大孔催化剂的重油转化率和总液体产物收率都比参比催化剂要高,且两类大孔催化剂的数据比较接近。催化剂的基质经模板扩孔后,由于具有微孔-介孔-大孔的梯度孔分布,孔径分布更加合理,重油分子在催化剂孔道内的扩散速率更快,容炭能力更强,所以大孔催化剂具有较好的裂化性能。

关键词: 聚苯乙烯 脱油残渣 大孔 重油 FCC催化剂

Abstract: Two types of macroporous catalysts were prepared by using polystyrene particles (PS) and de-oiled vacuum residue (VR) as templates; their pore structure and catalytic performance in the catalytic cracking of heavy oil (FCC) were investigated. Compared with the traditional catalyst without using template, two catalysts using the PS and VR templates exhibit an increase of BET surface area by 38.0% and 46.2%, an increase of pore volume by 20.6% and 35.8%, and an increase of average pore size by 54.5 % and 27.3 %, respectively. Meanwhile, the conversions of heavy oil over two catalysts using the PS and VR templates are also increased by 9.8% and 12.2%, and the total liquid yields are increased by 10.2% and 7.3%, respectively, compared with that over the traditional catalyst. After enduring coke deposition in FCC, the activity of the macroporous catalysts was decreased as was expected, but still higher than that of the traditional catalyst at similar situation. The macroporous catalysts own a reasonable pore distribution due to the pore expansion with templates, which promotes the mass transfer in the macropores of the catalysts and provide them with higher tolerance towards coke deposition; these may contribute to their excellent performance in the catalytic cracking of heavy oil.

Key words: polystyrene vacuum residue macroporous heavy oil FCC catalyst

收稿日期: 2011-11-28;

基金资助:

国家重点基础研究发展规划(973计划, 2004CB217808)。

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引用本文:


刘子媛,陈胜利,董鹏. 大孔FCC催化剂的制备及裂化性能研究[J]. 燃料化学学报, 2012, 40(09): 1092-1097.

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