

Cu_xCo_{1-x}/Al₂O₃/堇青石整体式催化剂的制备及其催化甲苯燃烧性能

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摘要 以堇青石蜂窝陶瓷为基底, Al₂O₃ 浆料为过渡胶体, Cu 和 Co 为催化活性组分, 制备了一系列 Cu_xCo_{1-x}/Al₂O₃//堇青石 (x = 0~1) 整体式催化剂. 采用 X 射线衍射、X 射线光电子能谱、扫描电镜和程序升温还原等手段对催化剂进行了表征. 以甲苯为模型化合物, 在微型固定床反应器上评价了催化剂的催化性能. 结果表明, 当Cu含量较低时, 在整体式催化剂上形成了Cu-Co-O 固溶体; 当 Cu 含量较高时, 可以检测到 CuO. 在催化剂表面, Co 以 Co²⁺ 和 Co³⁺ 形式存在, 而 Cu 主要以 Cu²⁺ 形式存在. 适量 Cu 的加入可以改善催化剂中 Co 的氧化还原性能, 有利于催化剂活性的提高. 在所制备的催化剂中, Cu_{0.5}Co_{0.5}/Al₂O₃/堇青石整体式催化剂活性最高, 在315 °C 可以完全催化燃烧消除甲苯.

关键词: 铜 钴 堇青石 整体式催化剂 甲苯 催化燃烧

Abstract: A series of Cu_xCo_{1-x}/Al₂O₃/cordierite (x = 0~1) catalysts were prepared using cordierite as a support, a boehmite primer sol as the first washcoat layer and copper as well as cobalt oxides as the activity washcoat layer. The structure of the catalysts was characterized using X-ray diffraction, X-ray photoelectron spectroscopy, scanning electron microscopy, and temperature-programmed reduction. Toluene was chosen as a model compound to evaluate the catalytic activity in a conventional fixed-bed quartz reactor. The results indicate that Cu-Co-O was present when the Cu content was low. CuO diffraction peaks were observed when the Cu content was high. Both Co²⁺ and Co³⁺ exist on the surface of the obtained monolithic catalysts while Cu²⁺ is the main Cu species. The addition of a certain amount of copper oxide improved the reducibility of the cobalt oxide, which enhanced the catalytic activity of the catalysts. All the obtained catalysts showed good activity for the catalytic combustion of toluene. The Cu_{0.5}Co_{0.5}/Al₂O₃/cordierite catalyst showed the best catalytic activity. Toluene was completely oxidized at 315 °C.

Keywords: copper, cobalt, cordierite, monolithic catalyst, toluene, catalytic combustion

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[1] e C, Li P, Cheng J, Wang H, Li J, Li Q, Hao Z. Appl Catal A, 2010, 382: 167 

[2] alacio L A, Velasquez J, Echavarría A, Faro A, Ribeiro F R, Ribeiro M F. J Hazard Mater, 2010, 177: 407 

[3] iu Z M, Wang J L, Zhong J B, Chen Y Q, Yan S H, Gong M C. J Hazard Mater, 2007, 149: 742 

[4] alacio L A, Silva J M, Ribeiro F R, Ribeiro M F. Catal Today, 2008, 133-135: 502 

[5] uang H, Liu Y, Tang W, Chen Y. Catal Commun, 2008, 9: 55 

[6] im K J, Ahn H G. Appl Catal B, 2009, 91: 308 

[7] arthik M, Lin L Y, Bai H. Microporous Mesoporous Mater, 2009, 117: 153 

















[8] hen M, Fan L, Qi L, Luo X, Zhou R, Zheng X. Catal Commun, 2009, 10: 838 

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- [9] u C Y, Wey M Y, Chen L I. Appl Catal A, 2007, 325: 163 
- [10] Liu Q Y, Liu Z Y, Wu W Z. Catal Today, 2009, 147: S285
- [11] Avila P, Montes M, Miro E E. Chem Eng J, 2005, 109: 11 
- [12] Li L, Xue B, Chen J, Guan N, Zhang F, Liu D, Feng H. Appl Catal A, 2005, 292: 312 
- [13] Cesar D V, Perez C A, Salim V M M, Schmal M. Appl Catal A, 1999, 176: 205 
- [14] Radwan N R E, Mokhtar M, El-Shobaky G A. Appl Catal A, 2003, 241: 77 
- [15] Ding X L, Yuan X X, Jia C, Ma Z F. Int J Hydrogen Energy, 2010, 35: 11077 
- [16] 师瑞娟, 王非, 牟效玲, 塔娜, 李勇, 黄秀敏, 申文杰. 催化学报 (Shi R J, Wang F, Mu X L, Ta N, Li Y, Huang X M, Shen W J. Chin J Catal), 2010, 31: 626 
- [17] Avgouropoulos G, Ioannides T, Matralis H. Appl Catal B, 2005, 56: 87 
- [18] Zhu P, Li J, Zuo S, Zhou R. Appl Surf Sci, 2008, 255: 2903 
- [19] Khassin A A, Yurieva T M, Kaichev V V, Bukhtiyarov V I, Budneva A A, Paukshtis E A, Parmon V N. J Mol Catal A, 2001, 175: 189 
- [20] Zhu J, Gao Q. Microporous Mesoporous Mater, 2009, 124: 144 
- [21] Wang C H. Chemosphere, 2004, 55: 11 
- [22] Li W B, Zhuang M, Wang J X. Catal Today, 2008, 137: 340 
- [23] Moretti E, Lenarda M, Storaro L, Talon A, Montanari T, Busca G, Rodriguez-Castellon E, Jimenez-Lopez A, Turco M, Bagnasco G, Frattini R. Appl Catal A, 2008, 335: 46 
- [24] Liu L, Chen Y, Dong L, Zhu J, Wan H, Liu B, Zhao B, Zhu H, Sun K, Dong L, Chen Y. Appl Catal B, 2009, 90: 105 
- [25] Zou Z Q, Meng M, Zha Y Q. J Alloys Compd, 2009, 470: 96 

- [1] 马建超, 刘帅, 范小鹏, 杜小宝, 闫喜龙, 陈立功. Cu₃₀Cr₅/碱性氧化铝催化 2,2,6,6-四甲基哌啶酮加氢[J]. 催化学报, 2012,33(4): 605-609
- [2] 陈亮, 沈俭一. 间苯二酚-甲醛树脂凝胶对Co/SiO₂催化剂费-托性能的影响[J]. 催化学报, 2012,33(4): 621-628
- [3] 杜治平, 周彬, 黄丽明, 黄晨, 吴元欣, 王存文, 孙炜. Cu(phen)Cl₂ 催化甲醇氧化羰基化合成碳酸二甲酯[J]. 催化学报, 2012,33(4): 736-742
- [4] 郭小惠, 李勇, 刘琪英, 申文杰. 微波辅助的多元醇法合成 CoNi 纳米材料[J]. 催化学报, 2012,33(4): 645-650
- [5] 方星, 陈崇启, 林性贻*, 余育生, 詹瑛瑛, 郑起. La₂O₃ 对 CuO/CeO₂ 水煤气变换反应催化剂微观结构及催化性能的影响[J]. 催化学报, 2012,33(3): 425-431
- [6] 万义玲, 张传辉, 郭杨龙, 郭耘, 卢冠忠. CeO₂-MnO_x 催化剂上氯乙烯有机废气的催化燃烧[J]. 催化学报, 2012,33(3): 557-562
- [7] 庞潇健, 陈亚中, 代瑞旗, 崔鹏. 柠檬酸络合法制备的 Co/CeO₂ 催化剂上中温乙醇水蒸气重整性能[J]. 催化学报, 2012,33(2): 281-289
- [8] 任利敏, 张一波, 曾尚景, 朱龙凤, 孙琦, 张海燕, 杨承广, 孟祥举, 杨向光, 肖丰收. 由新型铜胺络合物模板剂设计合成活性优异的 Cu-SSZ-13 分子筛[J]. 催化学报, 2012,33(1): 92-105
- [9] 王丹君, 陶芙蓉, 赵华华, 宋焕玲, 丑凌军. CO₂ 辅助老化制备的 Cu/ZnO/Al₂O₃ 催化剂上 CO₂ 加氢制甲醇[J]. 催化学报, 2011,32(9): 1452-1456
- [10] 王月娟, 郭美娜, 鲁继青, 罗孟飞, 介孔 Al₂O₃ 负载 PdO 催化甲烷燃烧反应性能[J]. 催化学报, 2011,32(9): 1496-1501
- [11] 单文娟, 刘畅, 郭红娟, 杨利华, 王晓楠, 冯兆池. 0, 1, 3 维 CeO₂ 的可控制备及 CuO/CeO₂ 催化剂上 CO 氧化反应[J]. 催化学报, 2011,32(8): 1336-1341
- [12] 张佳瑾, 李建伟, 朱吉钦, 王越, 陈标华. 助剂对 Cu-Mn 复合氧化物整体式催化剂催化低浓度甲烷燃烧反应性能的影响[J]. 催化学报, 2011,32(8): 1380-1386
- [13] 李京京, 刘兴海, 石雷, 孙琪, 周永刚, 徐健峰, 单作刚, 王福冬. 负载 CuO 基催化剂上 2,4-二氯酚的有效氧化降解[J]. 催化学报, 2011,32(8): 1387-1392
- [14] 何亭, 葛轶岑, 武垒垒, 付海燕, 陈华, 李贤均. 碘化亚铜/亚磷酸三乙酯催化碘代芳烃和末端炔烃的偶联反应[J]. 催化学报, 2011,32(8): 1376-1379
- [15] 朱海燕, 周朝华, 马兰, 程振兴, 沈俭一. SBA-15 的孔壁碳膜修饰对钴基催化剂结构与催化性能的影响[J]. 催化学报, 2011,32(8): 1370-1375