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研究论文

整体式 Pd/La_2O_3-Al_2O_3 和 Pd/CeO_2-ZrO_2-Y_2O_3 催化剂上汽油车尾气净化性能的比较

崔亚娟, 何胜楠, 方瑞梅, 史忠华*, 龚茂初, 陈耀强

四川大学化学学院, 绿色化学与技术教育部重点实验室, 四川成都 610064

CUI Yajuan, HE Shengnan, FANG Ruimei, SHI Zhonghua*, GONG Maochu, CHEN Yaoqiang

Key Laboratory of Green Chemistry & Technology of Ministry of Education, College of Chemistry, Sichuan University, Chengdu 610064, Sichuan, China

- 摘要
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摘要 采用共沉淀法制备了耐高温高比表面积的La_2O_3-Al_2O_3(LA) 材料和 CeO_2-ZrO_2-Y_2O_3 (CZY) 储氧材料, 并用浸渍法制备了整体式 Pd/LA 和 Pd/CZY 汽油车尾气净化三效催化剂, 考察了它们的三效催化性能和空燃比性能, 并单独通过水煤气变换和 CO 氧化反应性能的考察, 探讨了两种催化剂空燃比窗口扩大的原因. 结果表明, Pd/CZY 催化剂三效窗口明显较宽, 且催化氧化 CO 的性能明显更优; 对于 CO + NO 反应, Pd/CZY 催化剂的活性较高. 当反应中逐步通入 O_2 后, 抑制了该反应的进行, 但 CO 氧化的转化率升高, 而 NO 转化率降低, 直至 CO + NO 反应完全被抑制, 表明 CO 氧化反应对于抑制催化剂在 NO 贫燃方向的窗口具有一定的作用. 另外, Pd/CZY 催化剂上对于水煤气变换反应性能明显优于 Pd/LA 催化剂, 在一定温度下逐步通入 O2 后, 不会抑制水煤气变换反应的发生; 当逐步通入 NO 时, 可以促进水煤气变换反应的进行, 表明 Pd/CZY 催化剂在富燃时对扩展 CO 转化窗口的性能明显优于 Pd/LA 催化剂.

关键词: 储氧材料 耐高温材料 三效催化剂 水煤气变换 一氧化碳 氧化反应 氮氧化物

Abstract: Two kinds of support materials, the thermal-stability material La_2O_3-Al_2O_3 (LA) and oxygen storage material CeO_2-ZrO_2-Y_2O_3 (CZY), were prepared by co-precipitation. Pd/LA and Pd/CZY catalysts were prepared by impregnation and they were further fabricated as three-way catalysts in a monolith form. The Pd/LA and Pd/CZY three-way catalysts thus prepared were evaluated with a simulated automobile exhaust in terms of the relationships of three way performance with the air-to-fuel ratio (A/F) window and with temperatures. The results indicated that the A/F window and the three-way activity of the Pd/CZY catalyst were broader and higher than those of the Pd/LA catalyst. To investigate in more details, several reactions that involved CO in exhaust purification process such as CO oxidation, water-gas shift (WGS) reaction, and NO reduction by CO were examined over Pd/LA and Pd/CZY catalysts. These preliminary studies revealed that the advantages of the Pd/CZY catalyst is mainly from the unique properties of the CeO_2 oxygen storage material. Furthermore, it was found that addition of either O_2 or NO in reactant gases are favorable for the WGS reaction, which gives some clues for developing an advanced three-way purification process.

Keywords: oxygen storage material, thermal-stability material, three-way catalyst, water-gas shift, carbon monoxide, oxidization, nitrogen oxide

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[1] Lundie D T, McInroy A R, Marshall R, Winfield J M, Jones P, Dudman C C, Parker S F, Mitchell C, Lennon D. J Phys Chem B, 2005, 109: 11

[2] 龚茂初, 文梅, 高士杰, 章洁, 林之恩, 羊彦衡, 陈耀强, 许清淮, 李孝维, 郑林. 催化学报 (Gong M Ch, Wen M, Gao Sh J, Zhang J, Lin Zh E, Yang Y H Chen Y Q, Xu Q H, Li X W, Zheng L. Chin J Catal), 2000, 21: 404

[3] 龚茂初, 文梅, 高士杰, 章洁, 陈耀强, 羊彦衡, 潘桂黄. 天然气化工 (Gong M Ch, Wen M, Gao Sh J, Zhang J, Chen Y Q, Yang Y H, Pan G H. Natur Chem Ind), 2000, 25(1): 26

[4] 龚茂初, 林之恩, 高士杰, 章洁, 文梅, 陈耀强, 郑林, 许清淮, 李孝维. 燃料化学学报 (Gong M Ch, Lin Zh E, Gao Sh J, Zhang J, Wen M, Chen Y Q, Zh L, Xu Q H, Li X W. J Fuel Chem Technol), 2001, 29: 76

[5] Wu X D, Yang B, Weng D. J Alloys Compd, 2004, 376: 241

[6] Ozawa M, Nishio Y. J Alloys Compd, 2004, 374: 397

[7] Nagai Y, Yamamoto T, Tanaka T, Yoshida S, Nonaka T, Okamoto T, Suda A, Sugiura M. Catal Today, 2002, 74: 225

[8] Bedrane S, Descorme C, Duprez D. Catal Today, 2002,75: 401

[9] Kenevey K, Valdivieso F, Soustelle M, Pijolat M. Appl Catal B, 2001, 29: 93

[10] Chen L F, González G, Wang J A, Noreña L E, Toledo A, Castillo S, Morán-Pineda M. Appl Surf Sci, 2005, 243: 319

[11] 汪文栋, 林培琰, 孟明, 胡天斗, 谢亚宁, 刘涛. 中国稀土学报 (Wang W D, Lin P Y, Meng M, Hu T D, Xie Y N, Liu T. J Chin Rare Earth Soc), 2002, 265

[12] He H, Dai H X, Wong K W. Appl Catal A, 2003, 251: 61

[13] Bekyarova E, Fornasiero P, Kaspar J, Graziani M. Catal Today, 1998, 45: 179

[14] Hu Z, Wan C Z, Lui Y K, Dettling J, Steger J J. Catal Today, 1996, 30: 83

[15] Sadi F, Duprez D, Gerard F, Miloudi A. J Catal, 2003, 213: 226

[16] Liu Z Q, Anderson J A. J Catal, 2004, 224: 18

[17] Jacobs G, Chenu E, Patterson P M, Willioms L, Sparks D, Thomas G, Davis B H. Appl Catal A, 2004, 258: 203

[18] Jacobs G, Crawford A, Williams L, Patterson P M, Davis B H. Appl Catal A, 2004, 267: 27

[19] Hilaire S, Wang X, Luo T, Gorte R J, Wagner J. Appl Catal A, 2001, 215: 271

[20] Chan S H, Zhu J. J Inst Energy, 1996, 69: 144

[1] 张晓静, 李华举, 李勇, 申文杰.Sr 取代 $LaFeO_3$ 钙钛矿的结构性质和催化性能[J]. 催化学报, 2012,33(7): 1109-1114

[2] 张慧丽, 任丽会, 陆安慧, 李文翠.$Au/CeO_2/SiO_2$ 催化CO 低温氧化反应过程中CeO_2 的作用[J]. 催化学报, 2012,33(7): 1125-1132

[3] 汪国军, 郭耘, 卢冠忠.草酸处理对丙烷氨氧化催化剂 Sb-V-O 结构和催化性能的影响[J]. 催化学报, 2012,33(7): 1203-1208

[4] 邱文革, 王昱, 李传强, 展宗城, 訾学红, 张桂臻, 王锐, 何洪.活化温度对 CuBTC 催化 CO 氧化反应性能的影响[J]. 催化学报, 2012,33(6): 986-992

[5] 陈维苗, 丁云杰, 宋宪根, 朱何俊, 严丽, 王涛.助剂促进的 $Rh-Fe/Al_2O_3$ 催化剂上 CO 加氢制乙醇反应性能[J]. 催化学报, 2012,33(6): 1007-1013

[6] 唐富顺, 庄柯, 杨芳, 杨利利, 许波连, 邱金恒, 范以宁.负载型 V_2O_5/TiO_2 催化剂表面分散状态和性质对氨选择性催化还原 NO 性能的影响[J]. 催化学报, 2012,3