

柴油尾气DOC催化剂Pt-Pd/CeO₂的活性和抗硫性

 黄海凤¹, 王庐云¹, 漆仲华¹, 卢晗锋²

1. 浙江工业大学 生物与环境工程学院, 浙江 杭州 310014;

2. 浙江工业大学 催化反应工程研究所, 浙江 杭州 310014

Activity and sulfur resistance of Pt-Pd/CeO₂ catalysts for the oxidation of diesel exhaust

 HUANG Hai-feng¹, WANG Lu-yun¹, QI Zhong-hua¹, LU Han-feng²

1. College of Biological and Environmental Engineering, Zhejiang University of Technology, Hangzhou 310014, China;

2. Institute of Catalytic Reaction Engineering, Zhejiang University of Technology, Hangzhou 310014, China

- [摘要](#)
- [参考文献](#)
- [相关文章](#)
- [点击分布统计](#)
- [下载分布统计](#)

 全文: [PDF \(1851 KB\)](#) | [HTML \(1 KB\)](#) 输出: [BibTeX](#) | [EndNote \(RIS\)](#) | [背景资料](#)

摘要 采用浸渍法制备了不同Pt、Pd比例的Pt-Pd/CeO₂催化剂,考察了其催化氧化模拟柴油车尾气的活性,并测试了抗硫性。活性测试结果表明,Pt、Pd协同降低了催化剂的起燃温度,其比例对催化剂性能影响很大,其中,Pt_{0.2}Pd_{0.8}/CeO₂催化剂在模拟柴油车尾气(丙烯(C₃H₆)、一氧化碳(CO)和一氧化氮(NO))中的催化活性最高;C₃H₆的t₅₀降到170℃,CO的t₅₀降到了150℃,显示了良好的Pt、Pd协同效应;H₂-TPR表征和抗硫性结果分析表明,高比例Pt/Pd催化剂具有更多的表面活性氧,其相对数值与催化剂抗硫性能的关联度高,在催化剂硫酸盐中毒的条件下,更有利于催化反应的进行。

关键词: DOC催化剂 Pt-Pd协同 柴油尾气 抗硫性

Abstract: A series of Pt-Pd/CeO₂ catalysts with different Pt/Pd ratios were synthesized by impregnation method; their catalytic activity and sulfur resistance in the oxidation of diesel exhaust were investigated. The results showed that Pt-Pd synergy is able to reduce the ignition temperature and broaden the active window of Pt-Pd/CeO₂ catalysts for the oxidation of diesel exhaust. The ratio of Pt/Pd has a great effect on catalytic performance; The Pt_{0.2}Pd_{0.8}/CeO₂ catalyst shows the highest activity in the oxidation of simulated diesel exhaust containing C₃H₆, CO and NO. H₂-TPR results suggest that the amount of surface active oxygen increases with the Pt/Pd ratio, which is also well related to the sulfur resistance of the Pt-Pd/CeO₂ catalysts; higher Pt/Pd ratio is of benefit to the oxidation of diesel exhaust in the presence of SO₂, as the active sites of PtO₂ and PdO are easily covered by sulfate.

Key words: DOC catalyst Pt-Pd cooperative diesel exhaust sulfur resistance

收稿日期: 2013-02-06;

通讯作者: 卢晗锋, E-mail: luhf@zjut.edu.cn. E-mail: luhf@zjut.edu.cn.

引用本文:

黄海凤,王庐云,漆仲华等. 柴油尾气DOC催化剂Pt-Pd/CeO₂的活性和抗硫性[J]. 燃料化学学报, 2013, 41(11): 1401-1408.

HUANG Hai-feng, WANG Lu-yun, QI Zhong-hua et al. Activity and sulfur resistance of Pt-Pd/CeO₂ catalysts for the oxidation of diesel exhaust[J]. J Fuel Chem Technol, 2013, 41(11): 1401-1408.

链接本文:

<http://rlhxxb.sxicc.ac.cn/CN/> 或 <http://rlhxxb.sxicc.ac.cn/CN/Y2013/V41/I11/1401>

[1] 王建强, 王远, 刘双喜, 高继东, 马杰, 高海洋. 柴油车氧化催化技术研究进展[J]. 科技导报, 2012, 30(25): 68-73. (WANG Jian-qiang, WANG Yuan, LIU Shuang-xi, GAO Ji-dong, MA Jie, GAO Hai-yang. Progress in diesel oxidation catalysts[J]. Science & Technology Review, 2012, 30(25): 68-73.)






[2] 杨冬霞, 曹秋娥, 赵云昆, 计永波. 柴油车尾气净化铂催化剂的试验研究[J]. 稀有金属, 2005, 29(4): 485-489. (YANG Dong-xia, CAO Qiu-e, ZHAO

服务





- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [E-mail Alert](#)
- ▶ [RSS](#)

作者相关文章

- ▶ [黄海凤](#)
- ▶ [王庐云](#)
- ▶ [漆仲华](#)
- ▶ [卢晗锋](#)

- [3] 黎维彬, 林缨, 张雨, 孙立胜, 朱文彦. 含铂汽车尾气三效催化剂的研究[J]. 宁夏大学学报(自然科学版), 2001, 22(2): 199-200. (LI Wei-bin, LIN Ying, ZHANG Yu, SUN Li-sheng, ZHU Wen-yan. Catalytic emission removal on the Pt only three-way catalysts[J]. Journal of Ningxia University (Natural Science Edition), 2001, 22(2): 199-200.)
- [4] 张爱敏, 黄荣光, 宁平, 赵云昆, 贺小昆. 贵金属配比对催化剂活性的影响[J]. 贵金属, 2006, 27(1): 33-37. (ZHANG Ai-min, HUANG Rong-guang, NING Ping, ZHAO Yun-kun, HE Xiao-kun. Influences of precious metals ratio oil catalytic activities[J]. Precious Metals, 2006, 27(1): 33-37.)
- [5] TANJA K, TOMI K, MIKA H, MINNAMARI V, KAUKO K, TONI K, TOIVO L, JOUKO L, RIITTA K. The activity of Pt/Al₂O₃ diesel oxidation catalyst after sulphur and calcium treatments[J]. Catal Today, 2010, 154(3/4): 303-307. 
- [6] HAUFF K, TUTTLIES U, EIGONBERGER G, NIEKEN U. A global description of DOC kinetics for catalysts with different platinum loadings and aging status[J]. Appl Catal B: Environ, 2010, 100(1/2): 10-18. 
- [7] 刘欣梅, 吴韶亮, 阎子峰. 铈锆固溶体的合成及其在CH₄和CO催化燃烧反应中的应用[J]. 分子催化, 2010, 24(4): 344-350. (LIU Xin-mei, WU Shao-liang, YAN Zi-feng. Synthesis of ceria-zirconia solid solutions and their application in catalytic combustion reaction of CH₄ and CO[J]. Journal of Molecular Catalysis(China), 2010, 24(4): 344-350.)
- [8] PAOLO F, NEAL H, JAN K, CARLO D, DANIELE G, MAURO G. Redox and chemisorptive properties of ex-chloride and ex-nitrate Rh/Ce_{0.6}Zr_{0.4}O₂ catalysts[J]. J Catal, 189: 326-338.
- [9] 刘华彦. NO的常温催化氧化及碱液吸收脱除NO_x过程研究. 浙江: 浙江大学, 2011.
- [10] IDRIS A, NOELIA G H, AGUSTIN B L, AVELINA G G. Influence of the physico-chemical properties of CeO₂-ZrO₂ mixed oxides on the applied surface[J]. Science, 2010, 256: 7706-7712.
- [11] 杨春清, 周仁贤, 李振国. 耐高温高比表面Ce_xZr_{1-x}-Al复合氧化物的制备及其单Pd型三效催化性能的研究[J]. 浙江大学学报, 2008, 35(4): 428-432. (YANG Chun-qing, ZHOU Ren-xian, LI Zhen-guo. Preparation of Ce_xZr_{1-x}-Al mixed oxides and investigation of the palladium-only three-way catalytic performance[J]. Journal of Zhejiang University(Science Edition), 2008, 35(4): 428-432.)
- [12] 郭锡坤, 舒慧敏, 陈耀文. Cu/Ce_{1-y}Zr_yNi_xO₂/La-Al₂O₃催化剂的制备及性能[J]. 汕头大学学报(自然科学版), 2011, 26(1): 47-55. (GUO Xi-kun, SHU Hui-min, CHEN Yao-wen. Preparation and Catalytic Performance of Cu/Ce_{1-y}Zr_yNi_xO₂/La-Al₂O₃[J]. Journal of Shantou University(Natural Science), 2011, 26(1): 47-55.)
- [13] 喻瑶, 林涛, 张丽娟, 郭家秀, 龚茂初, 陈耀强. 钨钛复合氧化物的制备及用作Pt三效催化剂载体的性能[J]. 无机材料学报, 2008, 23(1): 71-76. (YU Yao, LIN Tao, ZHANG Li-juan, GUO Jia-xiu, GONG Mao-chu, CHEN Yao-qiang. Preparation of titanium-zirconium mixed oxide and its catalytic performance of Pt three-way catalysts[J]. Journal of Inorganic Materials, 2008, 23(1): 71-76.) 
- [14] 刘奇, 陈德茂, 刘艳, 翟步英, 杨晓亮, 阳浩, 张登友, 刘庆宾, 许俊强. 柴油车尾气净化用负载型催化材料及性能研究[J]. 功能材料, 2011, 8(42): 1512-1515. (LIU Qi, CHEN De-mao, LIU Yan, ZHAI Bu-ying, YANG Xiao-liang, YANG Hao, ZHANG Deng-you, LIU Qing-bin, XU Jun-qiang. Research of coating catalyzer materials and properties for tail gas filter of diesel vehicle[J]. Function Materials, 2011, 8(42): 1512-1515.)
- [15] 田久英, 卢菊生, 沐来龙. 三效催化剂用CeO₂ZrO₂固溶体的共沉淀制备研究[J]. 徐州师范大学学报(自然科学版), 2006, 24(1): 72-75. (TIAN Jiu-ying, LU Ju-sheng, MU Lai-long. Study on CeO₂ZrO₂ solid solution prepared by Co-precipitation method[J]. Journal of Xuzhou Normal University(Natural Science Edition), 2006, 24(1): 72-75.)
- [16] 韦岳长, 刘坚, 赵震, 姜桂元, 段爱军, 何洪, 王新平. CoO₂/Ce_{1-x}Zr_xO₂催化剂的制备、表征及其催化碳烟燃烧反应[J]. 催化学报, 2010, 31(3): 283-288. (WEI Yue-chang, LIU Jian, ZHAO Zhen, JIANG Gui-yuan, DUAN Ai-jun, HE Hong, WANG Xin-ping. Preparation and characterization of CoO₂/Ce_{1-x}Zr_xO₂ catalysts and their catalytic activity for soot combustion[J]. Chinese Journal of Catalysis, 2010, 31(3): 283-288.)
- [17] 张顺海, 蒋平平, 郭耘, 郭杨龙, 王筠松, 吴东方, 卢冠忠. 氧化共沉淀法制备纳米级铈锆固溶体[J]. 中国稀土学报, 2003, 12(z2): 64-66. (ZHANG Shun-hai, JIANG Ping-ping, GUO Yun, GUO Yang-long, WANG Yun-song, WU Dong-fang, LU Guan-zhong. Nanocrystal ceria-zirconia solid solution prepared by oxidation Co-precipitation method[J]. Journal of the Chinese rare earth society, 2003, 12(z2): 64-66.)
- [18] ZHONG F L, XIAO Y H, WENG X M, WEI K M, CAI G H, ZHENG Y, ZHENG Q. Thermally stable CeO₂-ZrO₂-La₂O₃ ternary oxides prepared by deposition-precipitation as support of Rh catalyst for catalytic reduction of NO by CO[J]. Catal Lett, 2009, 133(1/2): 125-133. 
- [19] 陈伟. 汽车尾气净化催化剂用Ce_xZr_{1-x}O₂固溶体的研究进展[J]. 内蒙古石油化工, 2010, 13: 7-11. (CHEN Wei. Study advance in Ce_xZr_{1-x}O₂ solid solution for auto catalyst[J]. Oil Chemical Technical of Nei Menggu, 2010, 13: 7-11.)
- [20] 钟富兰, 钟喻娇, 杨黄根, 肖益鸿, 蔡国辉, 郑勇, 魏可镁. Rh/CeO₂-ZrO₂-La₂O₃催化剂的结构、表面性能及DeNO_x活性的影响(英文)[J]. 无机化学学报, 2011, 27(12): 2473-2483. (HONG Fu-Lan, ZHONG Yu-Jiao, YANG Huan-Gen, XIAO Yi-hong, CAI Guo-hui, ZHENG Yong, WEI Ke-me. Effect of synthesis procedure on structural characteristics, surface properties and deNO_x activity of Rh/CeO₂-ZrO₂-La₂O₃ catalysts[J]. Chinese Journal of Inorganic Chemistry, 2011, 27(12): 2473-2483.)
- [21] ENACHE D I, EDWARDS J K, LANDON P, SOLSONA B E, CARLEY A F, HERZING A A, WATANABE M, KIELY C J, KNIGHT D W, HUTCHINGS G J. Solvent-free oxidation of primary alcohols to aldehydes using Au-Pd/TiO₂ catalysts[J]. Science, 2006, 311(5759): 362-365. 
- [22] 陈敏, 马莹, 宋萃, 张婷, 郑小明. Ce-Pt-Pd/不锈钢丝网催化剂的制备与催化性能[J]. 催化学报, 2009, 30(7): 649-653. (CHEN Min, MA Ying, SONG Cui, ZHANG Ting, ZHENG Xiao-ming. Preparation and performance of Ce-Pt-Pd/stainless steel wire meshes catalyst[J]. J Catal, 2009, 30(7): 649-653.)
- [23] 陈英, 何俊, 马玉刚, 陈小平, 王乐夫, 李雪辉. SO₂转化率提高NO_x储存还原催化剂Pt-Pd/BaO/TiAlO的制备及其抗硫性能[J]. 催化学报, 2007, 28(3): 257-263. (CHEN Ying, HE Jun, MA Yu-gang, CHEN Xiao-ping, WANG Le-fu, LI Xue-hui. Preparation of Pt-Pd/BaO/TiAlO catalyst for NO_x

storage-reduction and its sulfur resistance[J]. Chinese Journal of Catalysis, 2007, 28(3): 257-263.) 

- [24] ZHONG F L, ZHONG Y J, XIAO Y H, CAI G H, ZHENG Y, WEI K M. Sulfur resistance and activity of Pt/CeO₂-ZrO₂-La₂O₃ diesel oxidation catalysts[J]. Chinese Journal of Catalysis, 2011, 32(9): 1469-1476. 
- [25] 薛彬, 何洪, 戴洪兴, 瞿学红, 王亮, 王振阳. 氧化铈和铈锆固溶体对Pd催化剂抗硫性能影响的研究[J]. 工业催化, 2007, 15(9): 19-24. (XUE Bin, HE Hong, DAI Hong-xing, ZI Xue-hong, WANG Liang, WANG Zhen-yang. Effect of CeO₂ and Ce_{0.6}Zr_{0.4}O₂ solid solution on the sulfur tolerance of Pd₂ based catalysts[J]. Industrial Catalysis, 2007, 15(9): 19-24.) 
- [26] KEREN I, SHEINTUCH M. Modeling and analysis of spatiotemporal oscillatory patterns during CO oxidation in the catalytic converter[J]. Chem Eng Sci, 2000, 55(8): 1461-1475. 
- [27] SALOMONS S, HAYES R, VOTSMEIER M. On the use of mechanistic CO oxidation models with a platinum monolith catalyst[J]. Appl Catal B: Environ, 2007, 70(1/4): 305-313. 
- [1] 侯朝鹏, 夏国富, 李明丰, 聂红, 李大东. F-T合成催化剂羰基硫中毒热力学分析[J]. 燃料化学学报, 2012, 40(01): 68-74.
- [2] 刘大鹏, 卞俊杰, 李永丹. 硫存在下Beta沸石负载钯催化剂上的芳烃加氢性能研究[J]. 燃料化学学报, 2004, 32(05): 611-616.