

研究论文

Ce改性S<sub>2</sub>O<sub>2-8</sub>/Al-Zn-O固体酸的制备和催化性能

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**摘要:** 采用溶胶-凝胶法合成了S<sub>2</sub>O<sub>2-8</sub>/Al-Zn-O固体酸催化剂, 借助IR、XRD、TG/DSC和SEM对其结构和性能等进行了表征与分析, 研究了Ce的加入对催化合成乙酸正丁酯的催化活性和重复使用稳定性的影响。结果表明, 与S<sub>2</sub>O<sub>2-8</sub>/Al-Zn-O固体酸相比, S<sub>2</sub>O<sub>2-8</sub>/Al-Zn-Ce-O固体酸表现出更好的重复使用稳定性, 其重复使用5次后, 酯化率仍保持在94%以上, 而S<sub>2</sub>O<sub>2-8</sub>/Al-Zn-O固体酸重复使用4次后, 酯化率降低至61%。Ce的添加提高了固体酸的抗疏流失能力和抗聚集能力, 使其重复使用的稳定性提高。

**关键词:** 无机非金属材料 Al基固体酸 改性 酯化反应 催化性能

Preparation and Catalyst Properties of S<sub>2</sub>O<sub>2-8</sub>/Al-Zn-O Solid Acid Modified by Ce

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**Abstract:** S<sub>2</sub>O<sub>2-8</sub>/Al-Zn-Ce-O solid acid catalysts were synthesized by sol-gel. The structures and properties of the catalyst were characterized by means of infrared spectrum (IR), X-ray powder diffraction (XRD), thermogravimetric analysis-differential scanning calorimetry (TG/DSC) and scanning electron microscopy (SEM). The catalytic activities and reusabilities for the synthesis of n-butyl acetate from acetic acid and n-butanol were investigated. Compared with S<sub>2</sub>O<sub>2-8</sub>/Al-Zn-O solid acid catalyst, S<sub>2</sub>O<sub>2-8</sub>/Al-Zn-Ce-O solid acid catalyst exhibited better stability with above 94% esterification efficiency even after being used repeatedly for five times.

**Keywords:** inorganic non-metallic materials Al-based solid acids modification esterification reaction catalytic properties

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参考文献:

- [1] J.R.Sohn, D.C.Shin, Environmentally friendly solid acid catalyst prepared by modifying TiO<sub>2</sub> with cerium sulfate for the removal of volatile organic chemicals, Applied Catalysis B: Environmental, 77(3-4), 386(2008)
- [2] H.Z.Ma, J.Xiao, B.Wang, Environmentally friendly efficient coupling of n-heptane by

- sulfated tri-component metal oxides in slurry bubble column reactor, *Journal of Hazardous Materials*, 166(2-3), 860(2009)
- [3] G.X.Yu, X.L.Zhou, F.Liu, C.L.Li, L.F.Chen, J.A.Wang, Effect of isopropanol aging of Zr(OH)<sub>4</sub> on n-hexane isomerization over Pt-SO<sub>2</sub>-4 /Al<sub>2</sub>O<sub>3</sub>-ZrO<sub>2</sub>, *Catalysis Today*, 148(1-2), 70(2009)
- [4] M.Y.Smirnova, G.A.Urguntsev, A.B.Ayupov, A.A.Vedyagin, G.V.Echevsky, Isobutane/butene alkylation on sulfated alumina: Influence of sulfation condition on textural, structural and catalytic properties, *Applied Catalysis A: General*, 344(1-2), 107(2008)
- [5] WANG Junxia, MENG Dawei, YAN Hui, PAN Hui, YU Meihua, HAO Zhibo, Preparation and characterization of solid acid S<sub>2</sub>O<sub>2</sub>-8 /Al-Zn-O, *Journal of Functional Materials*, 41(5), 800(2010)
- [6] J.R.Sohn, S.H.Lee, J.S.Lim, New solid superacid catalyst prepared by doping ZrO<sub>2</sub> with Ce and modifying with sulfate and its catalytic activity for acid catalysis, *Catalysis Today*, 116(2), 143(2006)
- [7] WANG Yuhong, DONG Shunxi, LU Guanzhong, Structure and catalytic properties of SO<sub>2</sub>-4 /ZrO<sub>2</sub> catalyst modified by different rare earth compounds, *Chinese Journal of Inorganic Chemistry*, 23(4), 677(2007)
- [8] G.D.Fan, M.Shen, Z.Zhang, F.R.Jia, Preparation, characterization and catalytic properties of S<sub>2</sub>O<sub>2</sub>-8 /ZrO<sub>2</sub>-CeO<sub>2</sub> solid superacid catalyst, *Journal of Rare Earths*, 27(3), 437(2009)
- [9] YAO Ruiping, ZHANG Mingjin, YANG Jun, YI Delian, XU Jun, DENG Feng, YUE Yong, YE Chaohui, Preparation of SO<sub>3</sub>/γ-Al<sub>2</sub>O<sub>3</sub> solid acid catalyst and characterization of its structure and acidity, *Journal of Chemical Industry and Engineering*, 63(4), 269(2005)
- [10] A.L.C.Pereira, S.G.Marchetti, A.Albornoz, P.Reyes, M.Oportus, M.D.C.Rangel, Effect of iron on the properties of sulfated zirconia, *Applied Catalysis A: General*, 334(1-2), 187(2008)
- [11] M.K.Lam, K.T.Lee, A.R.Mohamed, Sulfated tin oxide as solid superacid catalyst for transesterification of waste cooking oil: An optimization study, *Applied Catalysis B: Environmental*, 93(1-2), 134(2009)
- [12] K.Tanabe, M.Misono, Y.Ono, H.Hattori, ZHENG Lubin, WANG Gongwei, ZHANG Yingzhen, YING Muliang, XU Boqing, *New Solid Acids and Bases: Their Catalytic Properties* (Beijing, Chemical Industry Press, 1991) p.193
- [13] B.Wang, J.P.Zhu, H.Z.Ma, Desulfurization from thiophene by SO<sub>2</sub>-4 /ZrO<sub>2</sub> catalytic oxidation at room temperature and atmospheric pressure, *Journal of Hazardous Materials*, 164(1), 256(2009)
- [14] LI Caolong, DENG Changwu, HU Xianzhi, ZI Futing, MA Yongping, Catalytic synthesis of cyclohexanone ethylene keta over solid superacid, *Journal of Molecular Catalysis*, 23(1), 37(2009)
- [15] J.R.Sohn, W.C.Park, The roles of active sites of nickel sulfate supported on γ-Al<sub>2</sub>O<sub>3</sub> for ethylene dimerization, *Applied Catalysis A: General*, 239(1-2), 269(2003)
- [16] G.X.Yu, X.L.Zhou, F.Liu, C.L.Li, L.F.Chen, J.A.Wang, Esterification over rare earth oxide and alumina promoted SO<sub>2</sub>-4 /ZrO<sub>2</sub>, *Catalysis Today*, 148(1-2), 169(2009)
- [17] SONG Hua, DONG Pengfei, ZHANG Xu, Effect of Al contents on the isomerization performance of solid superacid Pt-S<sub>2</sub>O<sub>2</sub>-8 /ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>, *Chemical Journal of Chinese Universities*, 31(7), 1426(2010)
- [18] GUO Haifu, CHEN Zhisheng, HAO Xiangying, YAN Peng, Preparation and characterization of solid superacid catalyst Ce<sup>4+</sup>-SO<sub>2</sub>-4 /SnO<sub>2</sub> prepared with

microemulsion method, Journal of Molecular Catalysis, 24(4), 291(2010)

- [19] WANG Yuhong, WANG Yuemin, LI Jun, Effect of vanadium modification on structure and catalytic properties of  $\text{SO}_2-4/\text{ZrO}_2\text{-Al}_2\text{O}_3$  solid acid catalyst, Chinese Journal of Catalysis, 29(8), 758(2008)
- [20] GU Xupeng, CHEN Tongyun, WAN Yubao, CHEN Huaxue, Study on synthesis of n-butylacetate with  $\text{SO}_2-4/\text{ZrO}_2\text{-TiO}_2\text{-La}$  Solid Superacid as Catalyst, Petrochemical Technology, 31(5), 353(2002)

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2. 檀雨默 张爱波 郑亚萍 兰岚 陈伟.具有固-液转变的磁性 $\text{Fe}_3\text{O}_4$ 纳米流体的制备、结构及性能[J]. 材料研究学报, 2011,25(6): 561-565
3. 魏晓玲 杨晖 沈晓冬. $\text{TiO}_2$ 掺杂对 $\text{Na-}\beta\text{-Al}_2\text{O}_3$ 性能的影响[J]. 材料研究学报, 2011,25(6): 597-601
4. 吴燕飞 黄英 张银铃 牛磊. $\text{Me}_2\text{-W}$ 型钨铁氧体的制备及其电磁性能研究[J]. 材料研究学报, 2011,25(6): 607-612
5. 吴宏伟 史铁钧 谭德新. $\text{Fe}_2\text{O}_3$ 对聚芳基乙炔树脂石墨化的影响研究[J]. 材料研究学报, 2011,25(6): 661-666
6. 彭家惠 瞿金东 张建新 邹辰阳 陈明凤.EDTA吸附特性及其对 $\alpha$ 半水脱硫石膏晶形的影响[J]. 材料研究学报, 2011,25(6): 566-572
7. 奚小网 胡林华 刘伟庆 戴松元.基于4-叔丁基吡啶的染料敏化太阳电池中电子传输研究[J]. 材料研究学报, 2011,25(6): 613-617
8. 董红周 董立峰.单壁碳纳米管负载Pt基二元金属催化剂对甲醇和乙醇氧化的电催化性能研究[J]. 材料研究学报, 2011,25(6): 579-584
9. 王树森, 梁成浩, 黄乃宝, 金光明.铝基牺牲阳极研究进展[J]. 材料研究学报, 2011,23(5): 369-375
10. 高勇 徐兴祥 杨振明 张劲松. $\text{TiC/Ti}_3\text{SiC}_2$ 泡沫陶瓷的制备和性能[J]. 材料研究学报, 2011,25(5): 539-544