

研究论文

PEG/CPB复配改性二氧化铅电极的制备和性能

杨武涛, 杨卫华, 付芳

华侨大学材料科学与工程学院 厦门 361021

摘要: 用电沉积法制备表面活性剂聚乙二醇(PEG)和溴化十六烷基吡啶(CPB)复配改性PbO₂电极,用SEM、XRD、电化学阻抗谱(EIS)和线性极化扫描(VA)等方法对其微结构和电化学性能进行了表征。结果表明,PEG/CPB复配改性在改善PbO₂镀层微结构中产生协同增效作用,使电极表面颗粒进一步细化均匀;复配改性电极明显提升了苯酚的催化降解活性,在2.5 h内对100 mg·L⁻¹苯酚溶液的降解率为98.7%。PEG/CPB复配改性电极电催化活性的提升与电极的活性表面积增大、电化学反应电阻减小和析氧电位的提高有关。

关键词: 无机非金属材料 二氧化铅电极 表面活性剂 复配改性 电催化

Preparation and Characterization of PbO₂ Electrode Modified With a Mixture of PEG and CPB

YANG Wutao, YANG Weihua, FU Fang

College of Material Science and Engineering, Huaqiao University, Xiamen 361021

Abstract: PbO₂ electrode modified with a mixture of polyethylene glycol (PEG, non-ionic surfactant) and cetylpyridinium bromide(CPB, cationic surfactant) was prepared by electrodeposition method. The micro-structure and electrochemical properties of the modified electrode were investigated by SEM, XRD, electrochemical impedance spectroscopy (EIS) and liner sweep voltammetry(VA) techniques. Results show that PEG and CPB display synergistic effect in improving the micro-structure of PbO₂ coating which refine the crystalline grains of electrode. The combined modification of PEG and CPB can enhance the electro-catalytic activity of PbO₂ electrode for phenol degradation, and 98.7% degradation ratio of phenol with an initial concentration of 100 mg · L⁻¹ can be obtained at 2.5 h. The modified electrode has larger active surface area, lower charge-transfer resistance and higher oxygen evolution potential, and these characteristics promote the electro-catalytic activity of the PbO₂ electrode for decomposition of organic matter.

Keywords: inorganic non - metallic materials lead dioxide electrode surfactant combined modification electro - catalysis

收稿日期 2011-10-09 修回日期 2011-11-23 网络版发布日期 2012-02-10

DOI:

基金项目:

国家自然科学基金21103055和华侨大学基本科研业务费专项基金JB--ZR1139资助项目。

通讯作者: 杨卫华

作者简介:

通讯作者E-mail: yangwh@hqu.edu.cn

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(884KB)
- ▶ [HTML] 下载
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 无机非金属材料
- ▶ 二氧化铅电极
- ▶ 表面活性剂
- ▶ 复配改性
- ▶ 电催化

本文作者相关文章

- ▶ 杨武涛
- ▶ 杨卫华
- ▶ 付芳

PubMed

- ▶ Article by Yang,W.S
- ▶ Article by Yang,W.H
- ▶ Article by Fu,f

- [1] FENG Ujie, LIU Junfeng, CUI Yuhong, Environmental Electrocatalytic Electrode-Structure, Characteristic and Preparation (Beijing, Science Press, 2010) p.3
- [2] M.Panizza, G.Cerisola, Influence of anode material on the electrochemical oxidation of 2-naphthol, *Electrochimica Acta*, 48(23), 3491(2003)
- [3] TONG Shaoping, ZHANG Tieming, MA Chun' an, Oxygen evolution behavior of PTFE-F-PbO₂ electrode in H₂SO₄ solution, *Chinese Journal of Chemical Engineering*, 16(6), 885(2008)
- [4] S.Ghasemi, M.F.Mousavi, M.Shamsipur, Electrochemical deposition of lead dioxide in the presence of polyvinylpyrrolidone: A morphological study, *Electrochimica Acta*, 53(2), 459(2007)
- [5] FU Fang, YANG Weihua, WANG Honghui, Preparation and performance of Ti-based lead dioxide electrode modified with polyethylene glycol, *Journal of Inorganic Materials*, 25(6), 653(2010)
- [6] S.Phoka, P.Laokul, E.Swatsitang, V.Promarak, S.Seraphin, S.Maensin, Synthesis, structural and optical properties of CeO₂ nanoparticles synthesized by a simple polyvinyl pyrrolidone (PVP) solution route, *Materials Chemistry and Physics*, 115(1), 423(2009)
- [7] HUO Chao, FAN Qingming, SHAO Hong, LI Yifan, LIU Huazhang, Catalytic performance of surfactant modified Ru catalysts supported on Ba-doped nano-magnesia for ammonia synthesis, *Journal of Chemical Engineering of Chinese Universities*, 22(3), 418(2008)
- [8] LIU Jinyan, HAN Waihui, ZHANG Yan, YAO Chaohuai, Studies on the conductivity of mixed reverse micelles of anionic and non-ionic surfactants, *Acta Physico-Chimica Sinica*, 26(6), 1552(2010)
- [9] YANG Weihua, FU Fang, YANG Wutao, Effect of polyvinylpyrrolidone on the microstructure and properties of PbO₂ electrode, *Chinese Journal of Materials Research*, 25(2), 199(2011)
- [10] M.Sathish, R.P.Viswanath, Electrochemical degradation of aqueous phenols using graphite electrode in a divided electrolytic cell, *Korean Journal of Chemical Engineering*, 22(3), 358(2005)
- [11] C.Guo, Y.Zuo, X.H.Zhao, J.M.Zhao, J.P.Xiong, Effects of surfactants on electrodeposition of nickel-carbon nanotubes composite coatings, *Surface and Coatings Technology*, 202(14), 3385(2008)
- [12] S.Abaci, U.Tamer, K.Pekmez, A.Yildiz, Electrosynthesis of benzoquinone from phenol on α and β surfaces of PbO₂, *Electrochimica Acta*, 50(18), 3655(2005)
- [13] X.P.Yang, R.Y.Zou, F.Huo, D.C.Cai, D.Xiao, Preparation and characterization of Ti/SnO₂-Sb₂O₃-Nb₂O₅/PbO₂ thin film as electrode material for the degradation of phenol, *Journal of Hazardous Materials*, 164(1), 367(2009)
- [14] LAO Guohong, SHAO Haibo, FAN Yuqian, WANG Jianming, ZHANG Jianqing, CAO Chunan, Catalytic oxidation of sulfide ion over a spherular-Co₃O₄ electrode, *Acta Physico-Chimica Sinica*, 27(3), 627(2011)
- [15] X.P.Zhu, J.R.Ni, H.N.Li, Y.Jiang, X.Xing, A.G.L.Borthwickb, Effects of ultrasound on electrochemical oxidation mechanisms of p-substituted phenols at BDD and PbO₂ anodes, *Electrochimica Acta*, 55(20), 5569(2010)
- [16] H.L.Liu, Y.Liu, C.Zhang, R.S.Shen, Electrocatalytic oxidation of nitrophenols in aqueous solution using modified PbO₂ electrodes, *Journal of Applied Electrochemistry*, 38(1), 101(2008)
- [17] H.Usuia, Electrochemical self-assembly synthesis of zinc oxide nanoparticles and

lamellar-structured organic/inorganic hybrids by electrodeposition in surfactant solution, *Electrochimica Acta*, 56(11), 3934(2011)

- [18] S.P.Tong, C.A.Ma, H.Feng, A novel PbO₂ electrode preparation and its application in organic degradation, *Electrochimica Acta*, 53(6), 3002(2008)

本刊中的类似文章

1. 曹晓晖 陈威宏 刘宇 孙杰 曹晓晖 王文举 于名讯.二次化学共沉淀法制备片状钡铁氧体的形成历程及磁性能研究[J]. *材料研究学报*, 2012,26(1): 107-112
2. 豆喜华 赵韦人 宋恩海 周国雄 易春雨 周民康.紫外激发蓝色荧光粉Sr_{2-x-y}B₅O₉Cl: xEu²⁺, yTb³⁺的合成和发光性能[J]. *材料研究学报*, 2012,26(1): 96-100
3. 刘义 李海金 张清 刘厚通.钙钛矿型热电氧化物Y_{0.95}R_{0.05}CoO₃ (R=Ca, Sr, Ba)的制备和热电性能[J]. *材料研究学报*, 2012,26(1): 31-36
4. 薛文斌 金乾 杜建成 华铭 吴晓玲.不锈钢表面阴极微弧电沉积氧化铝膜层的性能[J]. *材料研究学报*, 2012,26(1): 21-25
5. 殷大根 朱亚波 杜勇 刘晓霞 刘章生.微米螺旋碳纤维的电容特性[J]. *材料研究学报*, 2012,26(1): 73-77
6. 朱德如 刘先松 胡锋 JOSE Luis Menendez.明显增强的镧掺杂锶铁氧体的磁光克尔效应[J]. *材料研究学报*, 2012,26(1): 91-95
7. 王珉 赵军 艾兴 刘继刚.含有烧结助剂的复相陶瓷材料烧结过程的元胞自动机模拟[J]. *材料研究学报*, 2011,25(6): 618-624
8. 檀雨默 张爱波 郑亚萍 兰岚 陈伟.具有固-液转变的磁性Fe₃O₄纳米流体的制备、结构及性能[J]. *材料研究学报*, 2011,25(6): 561-565
9. 魏晓玲 杨晖 沈晓冬.TiO₂掺杂对Na-β"-Al₂O₃性能的影响[J]. *材料研究学报*, 2011,25(6): 597-601
10. 吴燕飞 黄英 张银铃 牛磊.Me₂-W型钡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