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硼掺杂碳化硅负载Pt催化剂的甲醇电催化氧化性能

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Boron-doped silicon carbide supported Pt catalyst for methanol electrooxidation

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摘要 以硼掺杂碳化硅（$B_{0.1}SiC$）为载体，采用循环伏安法在$B_{0.1}SiC$载体上电沉积Pt纳米粒子制备了$Pt/B_{0.1}SiC$催化剂。利用X射线光电子能谱、X射线衍射、氮气吸附-脱附、扫描电镜及透射电镜等测试方法对催化剂的晶型、表面性质及形貌进行了表征。结果表明，硼原子掺杂进入SiC晶格并取代了Si 位点，使$B_{0.1}SiC$载体的导电性增强；Pt纳米粒子均匀地分布在$B_{0.1}SiC$载体上，平均粒径为2.7 nm。与相同条件下制备的Pt/SiC催化剂相比，$Pt/B_{0.1}SiC$具有较大的电化学活性表面积、更高的甲醇催化氧化活性和稳定性。

关键词： 甲醇电氧化　硼掺杂碳化硅　Pt催化剂

Abstract: Boron-doped silicon carbide ($B_{0.1}SiC$) synthesized by the carbothermal reduction method was used as support to prepare $Pt/B_{0.1}SiC$ catalyst by cyclic voltammtric deposition of Pt nanoparticles. The crystal structure, surface property and morphology of the catalysts were studied with X-ray diffraction, X-ray photoelectron spectroscopy, scanning electron microscopy and transmission electron microscopy techniques and N_2 adsorption-desorption experiment. It is shown that B atoms have been incorporated into the SiC lattice sites by substituting Si,which increases the electrical conductivity of SiC. Pt nanoparticles uniformly dispersed on the $B_{0.1}SiC$ support with an average size of 2.7 nm. The prepared $Pt/B_{0.1}SiC$ had a larger electrochemically active area and exhibited higher electrocatalytic activity and stability for methanol oxidation than the Pt/SiC synthesized by the same method. This shows that B-doped SiC is a promising support for preparing high-performance methanol oxidation electrocatalysts.

Key words: methanol electrooxidation　B-doped SiC　Pt catalyst

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[1] WASMUS S, KUVER A. Methanol oxidation and direct methanol fuel cells: A selective review[J]. J Electroanal Chem, 1999, 461(1/2): 14-31.

[2] LIU H S, SONG C J, ZHANG L, ZHANG J J, WANG H J, WILKINSON D P. A review of anode catalysis in the direct methanol fuel cell[J]. J Power Sources, 2006, 155(2): 95-110.

[3] CHEN A C, HOLT-HINDLE P. Platinum-based nanostructured materials: Synthesis, properties, and applications[J]. Chem Rev, 2010, 110 (6): 3767-3804.

[4] ROEN L M, PAIK C H, JARVIC T D. Electrocatalytic corrosion of carbon support in PEMFC cathodes[J]. Electrochem Solid-State Lett, 2004, 7(1): A19-A22.

[5] KANGASNIEMI K H, CONDIT D A, JARVI T D. Characterization of vulcan electrochemically oxidized under simulated PEM fuel cell conditions[J]. J Electrochem Soc, 2004, 151(4): E125-E132.

[6] WANG Y J, WILKINSON D P, ZHANG J J. Noncarbon support materials for polymer electrolyte membrane fuel cell electrocatalysts[J]. Chem Rev, 2011, 111(12): 7625-7651.

[7] QIU Z, HUANG H, DU J, FENG T, ZHANG W K, GAN Y P, TAO X Y. NbC nanowire-supported Pt nanoparticles as a high performance catalyst for methanol electrooxidation[J]. J Phys Chem C, 2013, 117(27): 13770-13775.

[8] QIU Z, HUANG H, DU J,TAO X Y, XIA Y, FENG T, GAN Y P, ZHANG W K. Biotemplated synthesis of bark-structured TiC nanowires as Pt catalyst support with enhance delectrocatalytic activity and durability for methanoloxidation[J]. J Mater Chem A, 2014, 2(21): 8003-8008.

[9] FANG L, HUANG X P, VIDAL-IGLESIAS F J, LIU Y P, WANG X L. Preparation, characterization and catalytic performance of a novel Pt/SiC [J]. Electrochem Commun, 2011, 13(12): 1309-1312.

[10] LV H F, MU S C, CHENG N C, PAN M. Nano-silicon carbide supported catalysts for PEM fuel cells with high electrochemical stability and improved performance by addition of carbon[J]. Appl Catal B: Environ, 2010, 100(1/2): 190-196.

[11] TONG X L, DONG L L, JIN G Q, WANG Y Y, GUO X Y. Electrocatalytic performance of Pd nanoparticles supported on SiC nanowires for methanol oxidation in alkaline media[J]. Fuel Cells, 2011, 11(6): 907-910.

[12] DHIMAN R, JOHNSON E, SKOU E M, MORGEN P, ANDERSEN S M. SiC nanocrystals as Pt catalyst supports for fuel cell applications[J]. J Mater Chem A, 2013, 1(19): 6030-6036.

[13] LIU Z W, SHI Q Q, PENG F, WANG H J, YU H, LI J C, WEI X Y. Enhanced methanol oxidation activity of Pt catalyst supported on the phosphorus-doped multiwalled carbon nanotubes in alkaline medium[J]. Catal Commun, 2012, 22: 34-38.

[14] LIU Z W, SHI Q Q, PENG F, WANG H J, ZHANG R F, YU H. Pt supported on phosphorus-doped carbon nanotube as an anode catalyst for direct methanol fuel cells[J]. Electrochem Commun, 2012, 16(1): 73-76.

[15] KRIENER M, MURANAKA T, KATO J, REN Z A, AKIMITSU J, MAENO Y. Superconductivity in heavily boron-doped silicon carbide[J]. Sci Technol Adv Mater, 2008, 9(4): 044205.

[16] 董莉莉, 王英勇, 童希立, 靳国强, 郭向云. 硼掺杂SiC的制备、表征及其可见光分解水产氢性能[J]. 物理化学学报, 2014, 30(1): 135-140. (DONG Li-li, WANG Ying-yong, TONG Xi-li, JIN Guo-qiang, GUO Xiang-yun. Synthesis and characterization of boron-doped SiC for visible light driven hydrogen production[J]. Acta Physico-Chimica Sinica, 2014, 30(1): 135-140.)

[17] DONG L L, TONG X L, WANG Y Y, GUO X N, JIN G Q, Guo X Y. Promoting performance and CO tolerance of Pt nanocatalyst for direct methanol fuel cells by supporting on high-surface-area silicon carbide[J]. J Solid State Electrochem, 2014, 18(4): 929-934.

[18] OSWALD S, WIRTH H. Core-level shifts at B-and Al-doped 6H-SiC studied by XPS[J]. Surf Interface Anal, 1999, 27(3): 136-141. 3.0.CO;2-Z target="_blank">

[19] SEO W S, KOUMOTO K, ARAI S. Effects of boron, carbon, and iron content on the stacking fault formation during synthesis of beta-SiC particles in the system SiO_2-C-H_2[J]. J Am Ceram Soc, 1998, 81(5): 1255-1261.

[20] AGATHOPOULOS S. Influence of synthesis process on the dielectric properties of B-doped SiC powders[J]. Ceram Int, 2012, 38(4): 3309-3315.

[21] XIN Y C, LIU J G, JIE X, LIU W M, LIU F Q, YIN Y, GU J, ZOU Z G. Preparation and electrochemical characterization of nitrogen doped graphene by microwave as supporting materials for fuel cell catalysts[J]. Electrochim Acta, 2012, 60: 354-358.

[22] RALPH T R, HARDS G A, KEATING J E, CAMPBELL S A, WILKINSON D P, DAVIS M, STPIERRE J, JOHNSON M C. Low cost electrodes for proton exchange membrane fuel cells-Performance in single cells and Ballard stacks[J]. J Electrochem Soc, 1997, 144(11): 3845-3857.

[23] PARK S J, PARK J M. Preparation and characteristic of platinum catalyst deposited on boron-doped carbon nanotubes[J]. Curr Appl Phys, 2012, 12(5): 1248-1251.

[24] JEHNG J M, LIU W J, PAN T C, DAI Y M. Preparation of Pt nanoparticles on different carbonaceous structure and their applications to methanol electro-oxidation[J]. Appl Surf Sci, 2013, 268: 425-431.

[25] MU Y Y, LIANG H P, HU J S, JIANG L, WAN L J. Controllable Pt nanoparticle deposition on carbon nanotubes as an anode catalyst for direct methanol fuel cells[J]. J Phys Chem B, 2005, 109(47): 22212-22216.

[26] GUO S J, DONG S J, WANG E K. Three-dimensional Pt-on-Pd bimetallic nanodendrites supported on graphene nanosheet: facile synthesis and used as an advanced nanoelectrocatalyst for methanol oxidation[J]. Acs Nano, 2010, 4(1): 547-555.

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