催化学报 » 2011, Vol. 32 » Issue (6) :933-938 DOI: 10.1016/S1872-2067(10)60217-3

研究论文

Microwave-Assisted Preparation of CdS Nanoparticles in a Halide-Free Ionic Liquid a Their Photocatalytic Activities

M. ESMAILI, A. HABIBI-YANGJEH*

Department of Chemistry, Faculty of Science, University of Mohaghegh Ardabili, P.O. Box 179, Ardabil, Iran

M. ESMAILI, A. HABIBI-YANGJEH*

Department of Chemistry, Faculty of Science, University of Mohaghegh Ardabili, P.O. Box 179, Ardabil, Iran

摘要 A microwave-assisted (4－6 min) method was used for the preparation of CdS nanoparticles in 1-ethyl-3-methylimidazolium ethyl sulfate, a halide-free room-temperature ionic liquid (RTIL). The samples were characterized by powder X-ray diffraction, energy dispersive X-ray spectroscopy, and scanning electron microscopy. Diffuse reflectance spectra showed a 1.33 eV blue shift relative to bulk CdS. The photocatalytic activities of the nanoparticles for photodegradation of methylene blue (MB) using UV and visible light were measured. The photodegradation of MB decreased with calcination temperature. First order rate constants for the reaction under visible and UV irradiations over the nanoparticles prepared in the RTIL rich media were 5.4 and 2.5 higher, respectively, than the sample prepared in water.

关键词： nanoparticle cadmium sulfide room-temperature ionic liquid photocatalysis methylene blue

Abstract： A microwave-assisted (4－6 min) method was used for the preparation of CdS nanoparticles in 1-ethyl-3-methylimidazolium ethyl sulfate, a halide-free room-temperature ionic liquid (RTIL). The samples were characterized by powder X-ray diffraction, energy dispersive X-ray spectroscopy, and scanning electron microscopy. Diffuse reflectance spectra showed a 1.33 eV blue shift relative to bulk CdS. The photocatalytic activities of the nanoparticles for photodegradation of methylene blue (MB) using UV and visible light were measured. The photodegradation of MB decreased with calcination temperature. First order rate constants for the reaction under visible and UV irradiations over the nanoparticles prepared in the RTIL rich media were 5.4 and 2.5 higher, respectively, than the sample prepared in water.

Keywords： nanoparticle, cadmium sulfide, room-temperature ionic liquid, photocatalysis, methylene blue

收稿日期: 2011-01-11; 出版日期: 2011-06-07

引用本文:

M. ESMAILI, A. HABIBI-YANGJEH .Microwave-Assisted Preparation of CdS Nanoparticles in a Halide-Free Ionic Liquid and Their Photocatalytic Activities[J] 催化学报, 2011,V32(6): 933-938

M. ESMAILI, A. HABIBI-YANGJEH .Microwave-Assisted Preparation of CdS Nanoparticles in a Halide-Free Ionic Liquid and Their Photocatalytic Activities[J] Chinese Journal of Catalysis, 2011,V32(6): 933-938

链接本文:

http://www.chxb.cn/CN/ 10.1016/S1872-2067(10)60217-3 或 http://www.chxb.cn/CN/Y2011/V32/I6/933

[1] ui Y, Lieber C M. Science, 2001, 291: 851

[2] u H, Zhang W. Opt Mater, 2006, 28: 536

[3] eddy M P, Venugopal A, Subrahmanyam M. Appl Catal B, 2006, 69: 164

[4] u C H, Chern J M. Ind Eng Chem Res, 2006, 45: 6450

[5] alrymple O K, Yeh D H, Trotz M A. J Chem Technol Biotechnol, 2007, 82: 121

[6] eichner S J. J Porous Mater, 2008, 15: 311

[7] u W, Chen J, Wu L, Wang X, Wang X, Fu X. Appl Catal B, 2008, 77: 264

[8] ohamed S H. J Phys D, 2010, 43: 35406

[9] uhrer M S, Nygard J, Shih L, Forero M, Yoon Y G, Mazzoni M S C, Choi H J, Louie S G, Zettl A, Metuen P L. Science, 2000, 288: 494

[10] Li H L, Zhu Y C, Chen S G, Palchik O, Xiong J P, Koltypin Y, Gofer Y, Gedanken A. J Solid State Chem, 2003, 172: 102

[11] Datta A, Priyam A, Bhattacharyya S N, Mukherjea K K, Saha A. J Colloid Interface Sci, 2008, 322: 128

[12] Zong X, Yan H, Wu G, Ma G, Wen F, Wang L, Li C. J Am Chem Soc, 2008, 130: 7176

[13] Yu X X, Yu J G, Cheng B, Huang B B. Chem Eur J, 2009, 15: 6731

[14] Yu J, Zhang J, Jaroniec M. Green Chem, 2010, 12: 1611

[15] Lu X, Mao H, Zhang W, Wang C. Mater Lett, 2007, 31: 2288

[16] Shen S, Gao L. Mater Res Bull, 2008, 43: 437

[17] Barzegar M, Habibi-Yangjeh A, Behboudnia M. J Phys Chem Solids, 2010, 71: 1393

[18] Taghvaei V, Habibi-Yangjeh A, Behboudnia M. J Iran Chem Soc, 2010, 7: S175

[19] Zhang Z C. Adv Catal, 2006, 49: 153

[20] Jacob D S, Bitton L, Grinblat J, Felner I, Koltypin Y, Gedanken A. Chem Mater, 2006, 18: 3162

[21] Parvulescu V I, Hardacre C. Chem Rev, 2007, 107: 2615

[22] Wang Y, Yang H. J Am Chem Soc, 2005, 127: 5316

[23] Farag H K, Endres F. J Mater Chem, 2008, 18: 442

[24] Cao S W, Zhu Y J, Cheng G F, Huang Y H. J Hazard Mater 2009, 171: 431

[25] Xu C, Luo H, Liu W, Ying T. Ceramics Intern, 2009, 35: 917

[26] Keskin S, Kayrak-Talay D, Akman U, Hortacsu O. J Supercritical Fluids, 2007, 43: 150

[27] Najdanovic-Visak V, Esperanca J M S S, Rebelo L P N, da Ponte M N, Guedes H J R, Seddon K R, Szydlowski J. Phys Chem Chem Phys, 20 4: 1701

[28] Cammarta L, Kazarian S G, Salter P A, Welton T. Phys Chem Chem Phys, 2001, 23: 5192

[29] Wasserscheid P, Hal R, Bosmann A. Green Chem, 2002, 4: 400

[30] Panda A B, Glaspell G, El-Shall M S. J Am Chem Soc, 2006, 128: 2790

[31] Xiang Q J, Yu J G, Cheng B, Ong H C. Chem Asian J, 2010, 5: 1466

[32] Cao S W, Zhu Y J. Acta Materialia, 2009, 57: 2154

[33] Jiang Y, Zhu Y J. J Phys Chem B, 2005, 109: 4361

[34] Wang W W, Zhu Y J, Cheng G F, Huang Y H. Mater Lett, 2006, 60: 609

[35] Liu H, Liang Y, Hu H, Wang M. Solid State Sci, 2009, 11: 1655

[36] Dong W S, Li M Y, Liu C, Lin F, Liu Z. J Colloid Interface Sci, 2008, 319: 115

[37] Xu X, Zhang M, Feng J, Zhang M. Mater Lett, 2008, 62: 2787

[38] Wang L, Chang L, Zhao B, Yuan Z, Shao G, Zheng W. Inorg Chem, 2008, 47: 1443

[39] Gomez E, Gonzalez B, Calvar N, Tojo E, Dominguez A. J Chem Eng Data, 2006, 51: 2096

[40] Cullity B D. Elements of X-Ray Diffraction, 2nd Ed. London: Addision Wesley, 1978

[41] Arora S, Manoharan S S. Mater Chem Phys, 2008, 110: 34

[42] Baiju K V, Shukla S, Sandhya K S, James J, Warrier K G K. J Phys Chem C, 2007, 111: 7612

[43] Behnajady M A, Modirshahla N, Hamzavi R. J Hazard Mater B, 2006, 133: 226

[44] Testino A, Bellobono I R, Buscagalia V, Canevali C, Darienzo M, Plolizzi S, Scotti R, Morazzoni F. J Am Chem Soc, 2007, 129: 3564

[45] Wang S, Li H, Xu L. J Colloid Interface Sci, 2006, 295: 71

[46] Robert D. Catal Today, 2007, 122: 20

[47] Stroyuk A L, Kryukov A I, Ya Kuchmii S, Pokhodenko V D. Theor Exper Chem, 2005, 41: 207

[48] Harifi Mood A R, Habibi-Yangjeh A, Gholami M R. J Phys Chem B, 2006, 110: 7073

[49] Biswas K, Rao C N R. Chem Eur J, 2007, 13: 6123

[50] Antonietti M, Kuang D, Smarsly B, Yong Z. Angew Chem Int Ed, 2004, 43: 4988

[51] Behboudnia M, Habibi-Yangjeh A, Jafari-Tarzanag Y, Khodayari A. J Crys Growth, 2008, 310: 4544

[52] Taghvaei V, Habibi-Yangjeh A, Behboudnia M. Powder Technol, 2009, 195: 63