Generation of MoS2 quantum dots by laser ablation of MoS2 particles in suspension and their photocatalytic activity for H-2 generation

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JOURNAL OF NANOPARTICLE RESEARCH
Volume: 18 **Issue:** 8
Article Number: 240
DOI: 10.1007/s11051-016-3540-9
Published: AUG 12 2016
View Journal Impact

Abstract

MoS2 quantum dots (QDs) have been obtained in colloidal suspensions by 532 nm laser ablation (7 ns fwhp/pulse, 50 mJ/pulse) of commercial MoS2 particles in acetonitrile. High-resolution transmission electron microscopy images show a lateral size distribution from 5 to 20 nm, but a more homogeneous particle size of 20 nm can be obtained by silica gel chromatography purification in acetonitrile. MoS2 QDs obtained by laser ablation are constituted by 3-6 MoS2 layers (1.8-4 nm thickness) and exhibit photoluminescence whose lambda(PL) varies from 430 to 530 nm depending on the excitation wavelength. As predicted by theory, the confinement effect and the larger periphery in MoS2 QDs increasing the bandgap and having catalytically active edges are reflected in an enhancement of the photocatalytic activity for H-2 generation upon UV-Vis irradiation using CH3OH as sacrificial electron donor due to the increase in the reduction potential of conduction band electrons and the electron transfer kinetics.

Keywords

Author Keywords: Nanostructures; Few-layer chalcogenides; MoS2; Photocatalytic hydrogen generation; Photoluminescence; Energy conversion

KeyWords Plus: EDGE SITES; HYDROGEN EVOLUTION; GRAPHENE; NANOSHEETS; PHOTOLUMINESCENCE; NANOPARTICLES

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Funding

Funding Agency	Grant Number
Spanish Ministry of Economy and Competitiveness	CTQ-2012-32315
Generalitat Valenciana	
Deanship of Scientific Research (DSR), King Abdulaziz University	75-130-35-HiCi
KAU	
Spanish Ministry	

View funding text

Publisher

SPRINGER, VAN GODEWIJCKSTRAAT 30, 3311 GZ DORDRECHT, NETHERLANDS

Categories / Classification

Research Areas: Chemistry; Science & Technology - Other Topics; Materials Science

Web of Science Categories: Chemistry, Multidisciplinary; Nanoscience & Nanotechnology; Materials Science, Multidisciplinary

Document Information

Document Type: Article

Language: English

Accession Number: WOS:000383136100001

ISSN: 1388-0764

eISSN: 1572-896X

Other Information

IDS Number: DV7RZ

Cited References in Web of Science Core Collection: 38

Times Cited in Web of Science Core Collection: 1