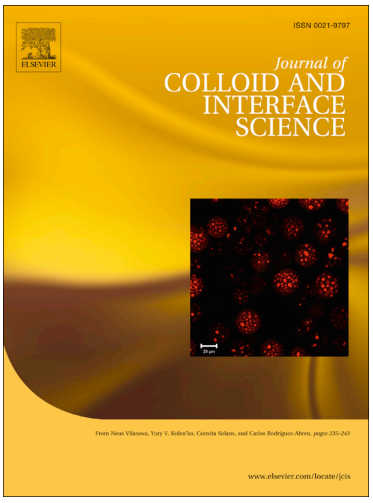

Transition metal-doped amorphous molybdenum sulfide/graphene ternary co-catalysts for excellent photocatalytic hydrogen evolution: synergistic effect of transition metal and graphene

Hualei Zhou, Yichen Liu, Li Zhang, Hongda Li, Hong Liu, Wenjun Li

PII: S0021-9797(18)30841-5
DOI: https://doi.org/10.1016/j.jcis.2018.07.084
Reference: YJCIS 23875

To appear in: *Journal of Colloid and Interface Science*

Received Date: 21 May 2018
Revised Date: 16 July 2018
Accepted Date: 20 July 2018

Please cite this article as: H. Zhou, Y. Liu, L. Zhang, H. Li, H. Liu, W. Li, Transition metal-doped amorphous molybdenum sulfide/graphene ternary cocatalysts for excellent photocatalytic hydrogen evolution: synergistic effect of transition metal and graphene, *Journal of Colloid and Interface Science* (2018), doi: https://doi.org/10.1016/j.jcis.2018.07.084

Transition metal-doped amorphous molybdenum sulfide/graphene ternary cocatalysts for excellent photocatalytic hydrogen evolution: synergistic effect of transition metal and graphene

Hualei Zhou*, Yichen Liu, Li Zhang, Hongda Li, Hong Liu, Wenjun Li
Beijing Key Laboratory for Science and Application of Functional Molecular and Crystalline Materials, Department of Chemistry and Chemical Engineering, University of Science and Technology Beijing, Beijing 100083, China.
*Corresponding author: hlzhou@ustb.edu.cn; +86 13691193561

Abstract

Though amorphous molybdenum sulfide (MoS_x) is considered a promising H_2 evolution cocatalyst, its intrinsic activity and charge transfer efficiency are still unsatisfactory. To overcome these drawbacks, transition metal-doped (Fe, Co, or Ni) amorphous MoS_x/graphene ternary nanocomposites were designed and fabricated using a one-step solvothermal method. Their structure, morphology, and properties were characterized. The metal-doped MoS_x nanoparticles were well distributed on the graphene sheets in the ternary composites. Metal doping greatly enhanced the intrinsic activity of amorphous MoS_x, and the integration of graphene notably promoted the separation of photoinduced carriers. The photocatalytic H_2 evolution with amorphous MoS_x as cocatalyst has been substantially improved under the synergistic effect of the transition metal and graphene. The H_2 evolution rate of Co-doped amorphous MoS_x/graphene composites reached 11.45 $mmol \cdot h^{-1} \cdot g^{-1}$ at the Co:Mo molar ratio of 2:3, which is 64% higher than that of Co-doped MoS_x, 21 times that of undoped MoS_x/graphene, and 127 times that of pure MoS_x. This study would supply an efficient strategy and a new vision for developing excellent noble-metal-free photocatalysts for photocatalytic hydrogen production.

Keywords: Amorphous molybdenum sulfide; Transitional metal; Graphene; Photocatalysis; Hydrogen Evolution

1. Introduction

Solar photocatalytic water splitting is considered a potential method to sustainably produce hydrogen energy and has been attracting huge interest over the past years