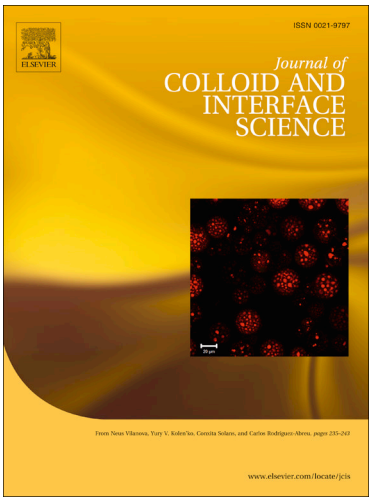

Fabrication of Phosphorus Nanostructures/TiO_2 Composite Photocatalyst with enhancing Photodegradation and Hydrogen Production from Water under Visible Light

Jing Wang, Dingke Zhang, Junkai Deng, Shijian Chen

PII: S0021-9797(18)30003-1
DOI: https://doi.org/10.1016/j.jcis.2018.01.003
Reference: YJCIS 23161

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

Received Date: 16 October 2017
Revised Date: 25 December 2017
Accepted Date: 2 January 2018

Please cite this article as: J. Wang, D. Zhang, J. Deng, S. Chen, Fabrication of Phosphorus Nanostructures/TiO_2 Composite Photocatalyst with enhancing Photodegradation and Hydrogen Production from Water under Visible Light, *Journal of Colloid and Interface Science* (2018), doi: https://doi.org/10.1016/j.jcis.2018.01.003

Fabrication of Phosphorus Nanostructures/TiO_2 Composite Photocatalyst with enhancing Photodegradation and Hydrogen Production from Water under Visible Light

Jing Wang [a], Dingke Zhang [b,*], Junkai Deng[c], Shijian Chen [a,c*]

[a] School of Physics, Chongqing University, Chongqing, 401331, China.
[b] College of Physics and Electronic Engineering, Chongqing Normal University, Chongqing, 401331, China.
[c] State Key Laboratory for Mechanical Behavior of Materials, Xi'an Jiaotong University, Xi'an, 710049, China.
*Corresponding author: Prof. Shijian Chen, E-mail: sjchen@cqu.edu.cn, Tel: +86-2365678362; Prof. Dingke Zhang, Email: zhangdk@cqnu.edu.cn

Abstract

As the world faces serious environmental pollution and energy shortage, developing Vis-light-driven photocatalysts for water splitting is highly attractive in clean energy utilization. Fabricating heterostructures has been proposed to be an efficient system to enhance the photocatalytic activity. However, synthesizing heterostructures with good contact and understanding charge transfer dynamics are still unresolved issues. In this work, a facile calcination approach was used to synthesize red phosphorus (RP) nanostructures/TiO_2 heterostructured composites. The RP nanostructures were directly grown on the TiO_2 nanoparticles with an intimate surface contact. By adjusting the molar ratio of amorphous RP to TiO_2 and the synthesizing temperature, thin nanorod-like RP nanostructures with a large exposed surface and a good surface contacting with TiO_2 were obtained. The synergetic effect of heterostructured RP/TiO_2 composites leads to an enhanced charge separation and transfer, and a better utilization of visible-light. As expected, the RP/TiO_2-700^oC composites exhibit good photocatalytic activity of degrading RhB and the optimal H_2 evolution rate. This work not only provides a method to prepare earth abundant elemental phosphorus well-contacted hetrostructures, expand the well-known UV-active TiO_2 photocatalyst to visible active, but also deepens understanding of charge transfer dynamics in heterostructured photocatalyst.

Keywords: Phosphorus nanostructures, Heterostructure, Photodegradation, H_2 evolution