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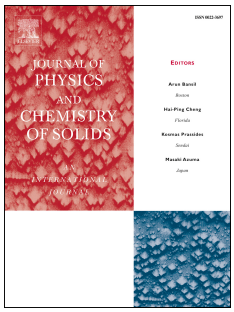

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PII: S0022-3697(17)32014-0

DOI: 10.1016/j.jpcs.2018.01.017

Reference: PCS 8381

To appear in: *Journal of Physics and Chemistry of Solids*

Received Date: 20 October 2017

Revised Date: 10 January 2018

Accepted Date: 11 January 2018

Please cite this article as: M. Yan, Y. Ma, H. Zhang, B. Ye, X. Dong, Enhanced photocatalytic activity of graphitic carbon nitride/cadmium sulfide heterojunctions by protonating treatment, *Journal of Physics and Chemistry of Solids* (2018), doi: 10.1016/j.jpcs.2018.01.017.

Enhanced photocatalytic activity of graphitic carbon nitride/cadmium sulfide heterojunctions by protonating treatment

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Abstract

Highly efficient visible-light-driven protonated g-C_3N_4 (pg-C_3N_4)/CdS heterojunctions with different weight ratios of CdS were prepared by treating g-C_3N_4 with hydrochloric acid and using an in-situ precipitation method. The structure and morphology of heterojunctions were investigated by X-ray powder diffraction (XRD), transmission electron microscopy (TEM), UV-vis diffuse reflectance spectroscopy (DRS), Fourier transform infrared spectroscopy (FTIR) and nitrogen adsorption technology. The as-prepared pg-C_3N_4/CdS heterojunction with 50 wt% of g-C_3N_4 exhibited much higher photocatalytic activity for photodegradation of methyl orange (MO) than pg-C_3N_4, CdS and g-C_3N_4/CdS without protonation as well, which could be contributed the activation of hydrochloric acid treatment and the improved electron–hole separation due to their overlapping band structure of CdS and pg-C_3N_4. A possible photocatalytic mechanism of the pg-C_3N_4/CdS heterojunction with superoxide radical species as the main active species in photocatalysis was proposed on the basis of experimental results.

Keywords

Protonated graphitic carbon nitride; CdS; Heterojunction; Visible light photocatalysis; Degradation

1. Introduction

The deteriorations of environment and natural resources have become the two major problems that threaten the survival of humans. Semiconductor photocatalysis technology as a green, low-cost and energy-saving route to deal with the above two difficulties has been extensively investigated during the past decades, such as photocatalytic water-splitting into H_2, photoreduction of CO_2 to methanol and decomposition of extremely toxic organic pollutants into harmless products [1-5]. Layered structures, especially their ultrathin derivates, have stimulated enormous research interest as efficient photocatalysts due to their unique properties, such as large surface area, short charge transfer distance and tunable surface functionality [6-10].