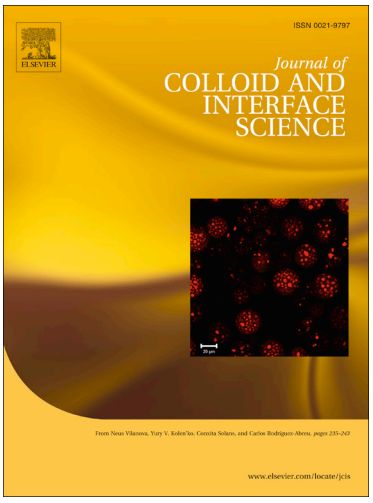

Multilayer ultrathin Ag-δ-Bi_2O_3 with ultrafast charge transformation for enhanced photocatalytic nitrogen fixation

Xiaoming Gao, Yanyan Shang, Libo Liu, Feng Fu

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Multilayer ultrathin Ag-δ-Bi_2O_3 with ultrafast charge transformation for enhanced photocatalytic nitrogen fixation

Xiaoming Gao, Yanyan Shang, Libo Liu, Feng Fu**

Department of Chemistry and Chemical Engineering, Shaanxi Key Laboratory of Chemical Reaction Engineering, Yan'an University, Yanan, Shaanxi 716000, China

Corresponding Author: Xiaoming Gao, dawn1026@163.com, Feng Fu, 394240365@qq.com

Abstract: Photocatalytic nitrogen fixation provides an attrachtive approach to produce reactive nitrogen compounds at benign conditions. Herein, Ag decorated δ-Bi_2O_3 photocatalyst, which has the features of multilayer ultrathin structure, suitable absorption edge and many exposed surface sites, is prepared by a hydrothermal and photoreduction process. Under visible light illustration, the obtained Ag-δ-Bi_2O_3 photocatalyst exhibits efficient photocatalytic activity for NH_4^+ generation at room temperature and atmospheric pressure in aqueous solution. The multilayer ultrathin sheets in the structure of Ag-δ-Bi_2O_3 favors the effective separation of photogenerated electron-hole pairs and fast interfacial charge transfer. Due to the Ag surface plasmonic resonance, obvious trap is formed in the ultrathin Ag-δ-Bi_2O_3 sheets, which not only inhibites the recombination of electron hole pairs but also produces light-induced oxygen vacancies under irradiation. Those factors significantly improve the photocatalytic ability of as-prepared Ag-δ-Bi_2O_3. The results provide insights into rational design of enhanced active photocatlysts with Ag surface plasmonic resonance and ultrafast charge carrier transfer for photocatalytic nitrogen fixation.

Key words: Multilayer photocatlysts, ultrafast charge transfer, surface plasmonic resonance, Nitrogen fixation, Visible light

1. Introduction

Photocatalytic nitrogen fixation is a promising approach for converting light energy into chemical energy[1-4]. In the early study, Schrauzer et al. [5] employed TiO_2 as photocatalyst to simultaneously convert N_2 and H_2O into NH_3 and O_2, respectively, oxygen under ultraviolet and light irradiation, which paved the way for nitrogen fixation via artificial photosynthesis. Since then, photocatalytic nitrogen fixation, especially the artificial photosynthesis of ammonia, has received considerable attention [6-8]. However, further study has demonstrated that the bond energy and the first electric potential of single molecule N≡N triple bond are as high as 941 kJ/mol and