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g-C_3N_4/Ag/TiO_2 Nanocomposites for Enhanced Photoelectrochemical Water Splitting under Visible Light

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Extended Abstract

Recently, one of the concerns that human beings are facing is energy crisis [1]. The non-renewable energy sources such as fossil energies such as coal, petroleum and natural gas are reducing progressively [1]. Hydrogen is growing attention as one of the most ideal fuel owing to its superior energy conversion performance and zero-carbon emission [2]. So, the photoelectrochemical (PEC) water splitting of semiconductor-based photoelectrodes which can transform solar energy into renewable hydrogen energy is a encouraging strategy to influentially use solar energy [1]. Metal oxide semiconductors are ideal materials for PEC generation of hydrogen owing to their optical and electrical features, ease of production and stability. Different metal oxides semiconductors such as an electrode, including TiO_2, ZnO, Fe_2O_3, BiOI and WO_3 have been utilized in PEC water splitting. However, the wide band gap (3.2 eV) of TiO_2 limits the absorption of the solar light because it only absorbs the photons in the ultraviolet part of the solar Energy [3]. Some methods such as noble metal doping, surface photosensitization and combining with narrow band semiconductors were applied to develop the photocatalytic performance. In recent years, metal free graphitic like carbon nitride (g-C_3N_4) nanomaterials have attracted a great deal of attention in the production H_2 from water under visible light irradiation. Conduction band and valence band potentials of g-C_3N_4 with a band gap of ~2.7 eV, are above the values of H_20 reduction and oxidation potentials, respectively [4].

In this study, g-C_3N_4/Ag/TiO_2 nanocomposite was synthesized for the PEC water splitting under visible light. When the PEC water splitting performance of g-C_3N_4/Ag/TiO_2 was compared to pure TiO_2, g-C_3N_4 and Ag/TiO_2, g-C_3N_4/Ag/TiO_2 illustrated the excellent performance. The excellent performance of g-C_3N_4/Ag/TiO_2 ternary nanocomposite is ascribed to its more visible light absorption and effective interfacial electron transfer owing to the synergetic interactions of Ag nanoparticles and TiO_2 and g-C_3N_4. As a result, this study indicates that the g-C_3N_4/Ag/TiO_2 nanocomposite has a significant potential application for PEC water splitting.

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