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$TiO_2/Ti_3C_2/g\text{-}C_3N_4$ ternary heterojunction for photocatalytic hydrogen evolution

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ABSTRACT

Photocatalytic hydrogen (H_2) generation derived by water has been considered as a renewable energy to solve environmental problems and global energy crises. Thus, it is necessary to explore the most effective photocatalysts by using multi-cocatalysts, due to an intimate interaction between different components. Therefore, we already synthesized the $TiO_2/Ti_3C_2/g\text{-}C_3N_4$ (TTC) photocatalyst from $g\text{-}C_3N_4$ and Ti_3C_2 MXene via a calcination technique, and applied this composite for H_2 evolution. By making use of titanium atom from Ti_3C_2 MXene, titanium dioxide (TiO_2) was in-body developed, which leads to form a close heterostructure between metallic material and semiconductors. Besides, $g\text{-}C_3N_4$ amorphous with highly surface area also contributes to harvest light irradiation during photocatalytic activity. The optimized TTC-450 heterostructure showed a super H_2 generation efficiency than those of pure $g\text{-}C_3N_4$ and other samples. Besides, TTC-450 sample also exhibited great recyclability after 4 runs. The proposed mechanism illustrates the efficient movement of generated electrons in TTC system, which leads to high H_2 evolution efficiency. Moreover, the obtained results consistently emphasize the $TiO_2/Ti_3C_2/g\text{-}C_3N_4$ composite would be a unique material for H_2 production and broaden applications of MXene materials.

1. Introduction

In recent decades, exploiting alternative energy source to replace fossil energy and curb with energy crisis has promoted relentless efforts of international researchers (Anh Tran et al., 2021; H. Zhang et al., 2020). The generation of hydrogen (H_2) derived from photocatalytic

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