Insight into the physicochemical properties and enhanced photocatalytic hydrogen production of Pt/g-C_3N_4 ultrathin nanosheets

M. Zografaki[1,2*], V. Binas[1,2,]**

[1]Institute of Electronic Structure and Laser (IESL), FORTH, P.O. Box 1527, Vasilika Vouton, GR-71110 Heraklion, Greece

[2]Department of Chemistry, Aristotle University of Thessaloniki, University Campus, 54124 Thessaloniki, Greece

(*mzografaki@iesl.forth.gr, mzografa@chem.auth.gr)

(**binasbill@iesl.forth.gr, vbinas@chem.auth.gr)

ABSTRACT

Photocatalytic H_2 production is crucial to address the global fossil fuel crisis and promote sustainability worldwide. Despite efforts to develop high-efficiency systems, photocatalysts still struggle with charge-carrier recombination. However, adding co-catalysts can help improve the H_2 production efficiency[1,2]. Noble metals like platinum (Pt) are considered efficient co-catalysts, and recently g-C_3N_4 has gained attention for its stability, nontoxicity, and visible-light response. The coupling of graphitic carbon nitride nanosheets with cocatalyst platinum (Pt) and hole sacrificial agents, often shows improved H_2-production activity[1,3,4]. Herein, we present the use of Pt nanoparticles anchored on g-C_3N_4 nanosheet (Pt_CNNs)[5] for the H_2 generation using TEOA (triethanolamine) as hole sacrificial. The Pt_CNNs photocatalysts were prepared through a photodeposition process with g-C_3N_4 and H_2PtCl_6 solution, and perform great stability with remarkably enhanced H_2 production compared to pure CNNs. More specifically, the 1%Pt_CNNs exhibits significantly enhanced hydrogen production activity with an evolution rate of 1236,0 μmol/h (or 61,8 mmol/g*h) under solar irradiation (λ>360 nm). Moreover, 0.5%Pt_CNNs shows an evolution rate of 376.2 μmol/h (or 18.8 mmol/g*h) under visible irradiation (λ>420nm) surpassing the performance of previous photocatalysts based on C_3N_4. Additionally, a detailed mechanism behind this phenomenon will be conducted. This work offers an easy way to use noble metallic Pt for efficient solar energy conversion and utilization.

KEYWORDS: Graphitic carbon nitride, Platinum, enhanced H_2 production, Cocatalyst photodeposition

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