

In situ growth of g-C₃N₄ on TiO₂ nanotube arrays: Construction of heterostructures for improved photocatalysis properties

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ABSTRACT

In this work, we successfully constructed g-C₃N₄/TNTs heterostructures via in situ growth of g-C₃N₄ on the surface of TiO₂ nanotube arrays (TNTs). Varying concentrations of urea precursor were adopted to prepare the binary composites for the photodegradation of methylene blue (MB). Advanced microscopic and spectroscopic approaches such as FESEM, PL-Raman, UV-vis DRS, XRD and etc examined the topography, structural and optical properties attributed to the presence of g-C₃N₄ in the heterostructures. The morphological analysis showed that the in-situ growth of g-C₃N₄ onto the surface of TNTs significantly increased the wall thickness of the nanotubes. The least band energy of 1.8 eV was obtained by g-C₃N₄/TNTs (1.5 g) due to the formation of an impurity energy level induced by the presence of g-C₃N₄. The electron transfer between the heterojunction of g-C₃N₄ and TNTs was revealed by the quenching of PL emission intensity. When the urea content was optimized at 1.0 g, the build-in electric field at the interface of g-C₃N₄/TNTs stimulated the electrons transfer and prolonged lifetime of carriers, thus enhancing the degradation efficiency by 1.25 times higher than that of pure TNTs. However, the aggregation of g-C₃N₄ as a result of increasing urea content (1.5–2.0 g) reduced the interfacial adhesion at the heterojunction between the g-C₃N₄ and TNTs, thus dominating its excellent optical and charge separation properties and diminishing the degradation efficiency of MB.

KEYWORDS

Aromatic compounds; Degradation; Electric fields; Heterojunctions; Metabolism; Nanotubes; Titanium dioxide; Topography; Urea

DOI: <https://doi.org/10.1016/j.jece.2019.103611>

ACKNOWLEDGEMENT

This work was supported by the Fundamental Research Grant Scheme ([FRGS/1/2019/TK10/UTAR/02/5](#)).