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Novel g-C<sub>3</sub>N<sub>4</sub>/h<sup>+</sup>ZnTiO<sub>3</sub>-a<sup>+</sup>TiO<sub>2</sub> direct Z-scheme heterojunction with significantly enhanced visible-light photocatalytic activity

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# Novel g-C<sub>3</sub>N<sub>4</sub>/h'ZnTiO<sub>3</sub>-a'TiO<sub>2</sub> direct Z-scheme heterojunction with significantly enhanced visible-light photocatalytic activity

Xibao Li\*, Jie Xiong, Juntong Huang\*, Zhijun Feng, Junming Luo

*School of Materials Science and Engineering, Nanchang Hangkong University,  
Nanchang 330063, China*

**ABSTRACT:** Novel g-C<sub>3</sub>N<sub>4</sub>/h'ZnTiO<sub>3</sub>-a'TiO<sub>2</sub> (CN/h'ZT-a'T) ternary composites were successfully prepared by combining in-situ precursor-synthesized h'ZnTiO<sub>3</sub>-a'TiO<sub>2</sub> (h'ZT-a'T) nanoparticle with nanoporous g-C<sub>3</sub>N<sub>4</sub> (CN) powders. X-ray diffraction (XRD), Transmission electron microscopy (TEM), and X-ray photoelectron spectroscopy (XPS) results revealed that the grains of hexagonal-phase ZnTiO<sub>3</sub> (h'ZT) were in-situ generated together with anatase-phase TiO<sub>2</sub> (a'T), forming a symbiotic structure of tightly bonded interface. Compared with CN and h'ZT-a'T, the absorption edge of CN/h'ZT-a'T exhibited a red-shift and the absorption intensity was obviously enhanced. With increasing CN content, the degradation efficiency of CN/h'ZT-a'T for methylene blue (MB) initially increased and then decreased, reaching the highest value of 99.8% with the CN content of 50 wt% (50CN/h'ZT-a'T). The 50CN/h'ZT-a'T composites exhibited the highest apparent reaction rate constant of 2.92 h<sup>-1</sup>, which was 37.4 and 3.0 times higher than that of h'ZT-a'T and CN, respectively. Photocurrent response of 50CN/h'ZT-a'T was indicative of the highest photocurrent value and the elongated lifetime of photogenerated charges. The greatly enhanced photocatalytic activity was attributed to the high mobility of photogenerated electrons. H'ZnTiO<sub>3</sub> with high electron mobility in the direct Z-scheme heterojunction played a role of electronic transfer station and reduced the recombination probability of photogenerated carriers.

**Keywords:** Direct Z-scheme; Heterojunctions; Photocatalytic; Electron mobility

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\* Corresponding author. E-mail: lxbicf@126.com (Xibao Li), Tel: +86 791 83863031, huangjt@nchu.edu.cn (Juntong Huang)

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