Synergetic photocatalytic nanostructures based on Au/TiO_2/reduced graphene oxide for efficient degradation of organic pollutants

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The world environmental pollution and water pollution became more and more serious [1]. Recently, there is crucial interest in the design and fabrication of nanocatalysts for efficient decomposition of organic pollutants in wastewater using visible light [2, 3]. This work reports the assembling fabrication of synergetic photocatalytic Au/TiO_2/RGO nanostructures by utilizing the reduced graphene oxide (RGO) as substrate material and efficient separator for electrons and holes. Au NPs were introduced to enhance the ability of harvesting visible light, and the RGO nanosheets would contribute to concentrate organic pollutants near the catalysts and act as efficient separator for the photo-generated electron-hole pairs. The Au/TiO_2/GO nanocomposites were used as high efficient photocatalysts for the degradation of organic pollutants. High resolution TEM image of the Au/TiO_2/RGO revealed the most intensive <101> diffracting plane of anatase TiO_2 with a d-spacing of 0.35 nm. And the single crystalline Au NP with the average size of ~4 nm in diameter presented lattice images of <111> plane was attached on the TiO_2 (Figure 1a). The degradation efficiency after 1 hour for hydroquinone under visible light is ~77% (Figure 1b). Under visible light, the calculated apparent rate (k) of the Au/TiO_2/RGO nanocomposites is 0.0174 min^{-1} for decomposition of hydroquinone. The high photocatalytic activity is mainly attributed to the synergy between RGO and Au/TiO_2 nanostructure. The strategy of composite nanostructures assembling on RGO is ensured to have a great practicable potential for the designing of high efficient multielement composite nanoparticles catalysts.

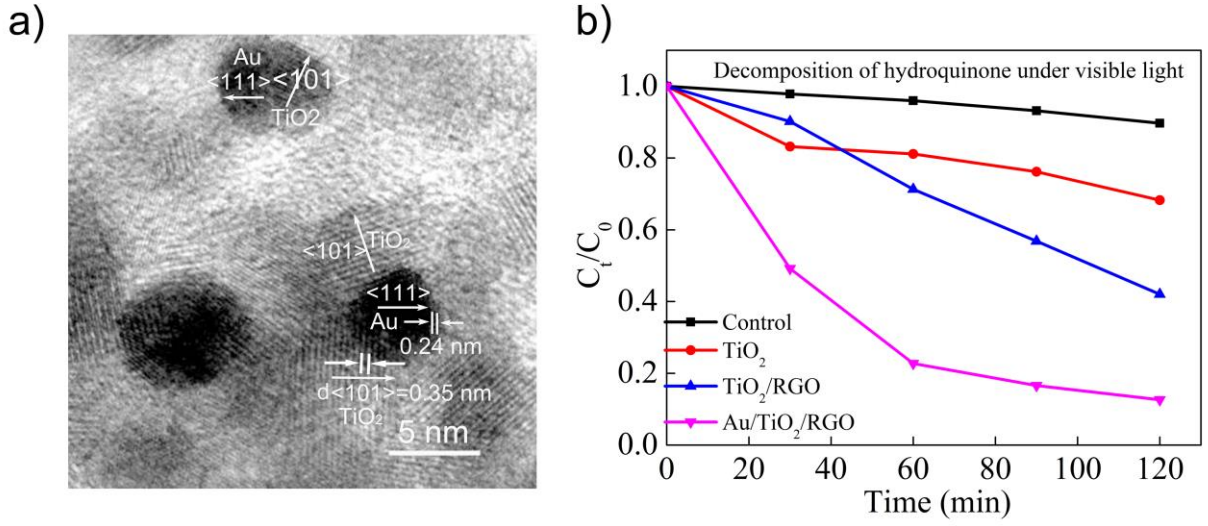

Figure 1. (a) High resolution TEM image of Au/TiO_2/RGO composite showing close contacts and lattice correlations between the Au NPs and TiO_2 nanocrystals. (b) Photocatalytic degradation of hydroquinone under visible illumination.

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