A quaternary TiO_2/ZnO/RGO/Ag nanocomposite with enhanced visible light photocatalytic performance

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Synthesis of graphene oxide:

Modified Hummers Method:

Graphene Oxide was synthesized using a modified Hummers method[1]. Briefly, 0.5 g of graphite and 0.5 g of $NaNO_3$ in 23 mL of 12.1 M H_2SO_4 were stirred in an ice bath to yield a purple-green mixture. This suspension was transferred to a 40°C water bath and magnetically stirred for 90 min. the dark brown colored paste was diluted with slow addition of 50 mL of deionized water (DI) and allowed to stir for a further 10 min. A 6 mL portion of H_2O_2 was slowly added to quench the solution to produce a golden brown sol. A further 50 mL of DI water was added, and the resultant product centrifuged and washed with warm DI water repeatedly to adjust the pH ~6. Finally the product was dried at 80°C for 24 h.

Interpretation of XRD

The XRD peak for graphite powder occurs at 26.37^0, which can be indexed to (002) plane with interplanar spacing 0.338 nm, due to the tightly packed monolayers of carbon, while after oxidation a new peak is formed at 9.48^0, owing to the introduction of hydroxyl, epoxy, carbonyl and carboxl gropus in GO. When GO is reduced to RGO, a new broad peak is formed at 24.1^0 with an interlayer spacing of 0.372 nm, indicating the removal of majority of the functional gropus[2].

Interpretation of TGA curves

TGA was conducted for both GO and TZGA samples at temperatures ranging from 30°C to 800°C (Figure 4). The TG curve of the GO sample (Fig. S4) shows a major weight loss (approximately 12 wt.%) below 100°C, which can be attributed to the removal of absorbed water[3]. As the temperature increased, the GO has lost approximately 36 wt.% due to the pyrolysis of oxygenated functional groups. On the other hand, TZGA underwent similar weight loss within the same temperature range at a lower rate than that of the GO sample (Fig. S4)). This can be attributed to the reduction of thermally unstable oxygenated functional groups on the TZGA sample, which is consistent with the FTIR results. The greater thermal stability of the TZGA sample may also be due to the existence of AgNP[4].

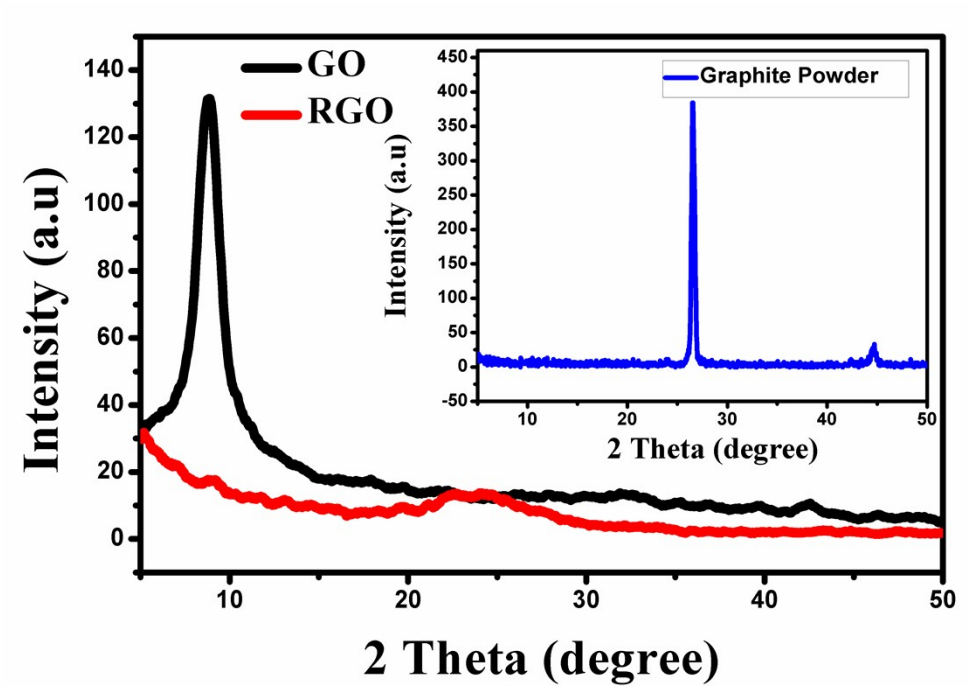

Fig.S1: XRD pattern of graphite powder and graphene oxide and RGO

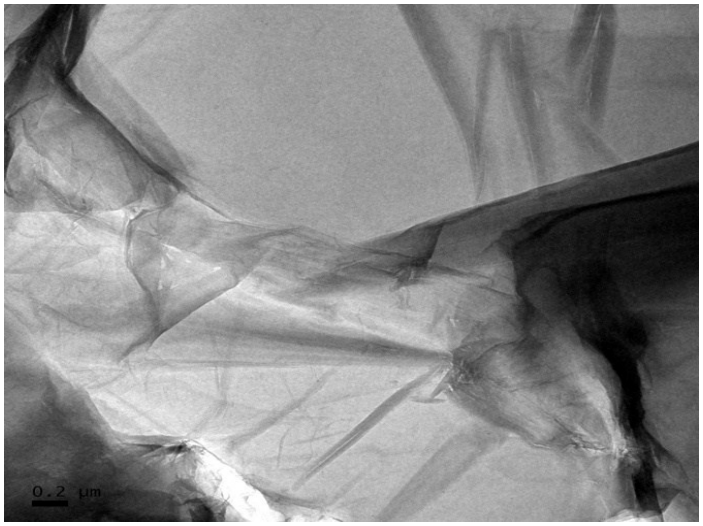

Fig. S2: TEM image of graphene oxide

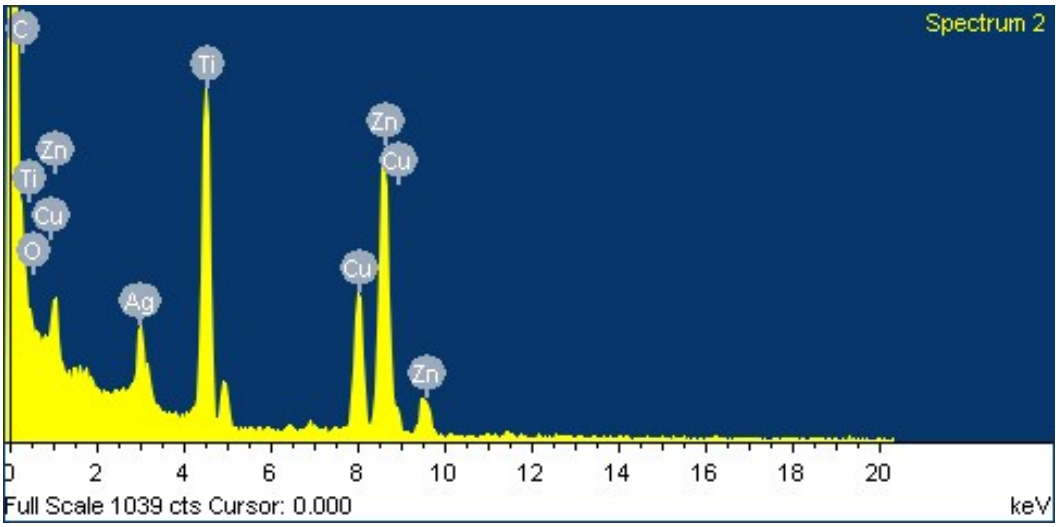

Fig.S3: EDAX spectra of TZGA nanocomposites

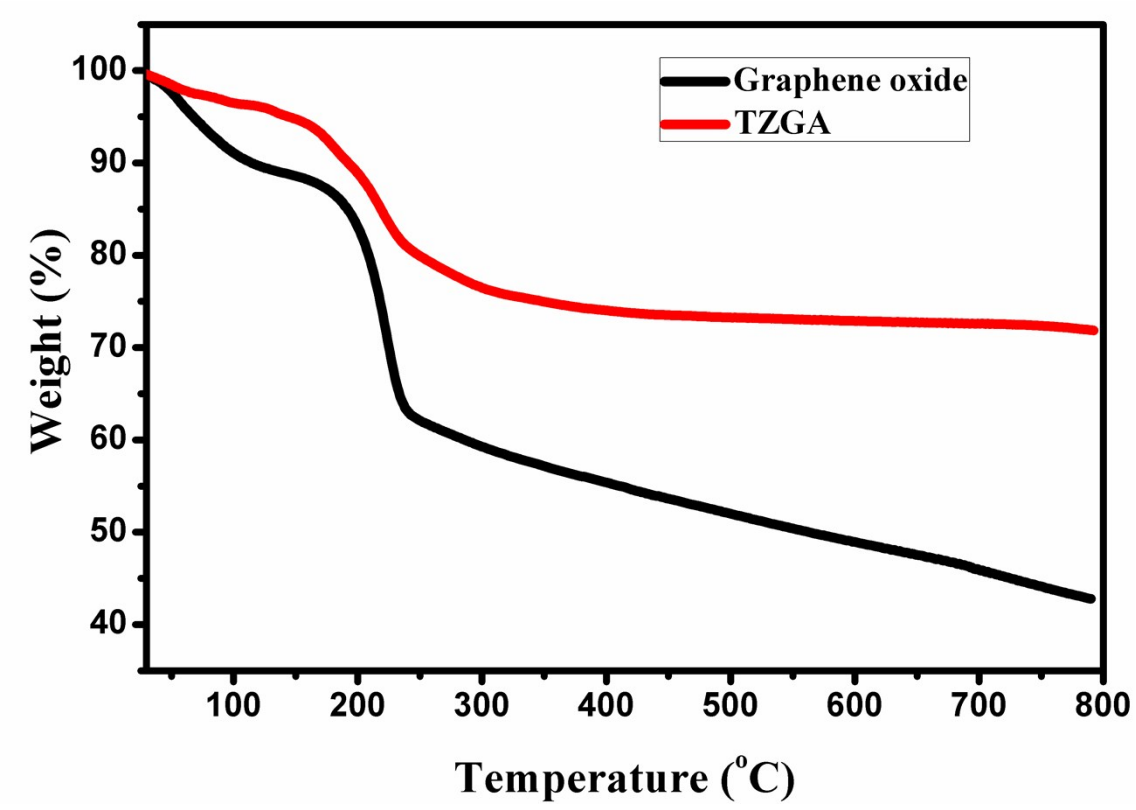

Fig.S4: TGA curves of the composites

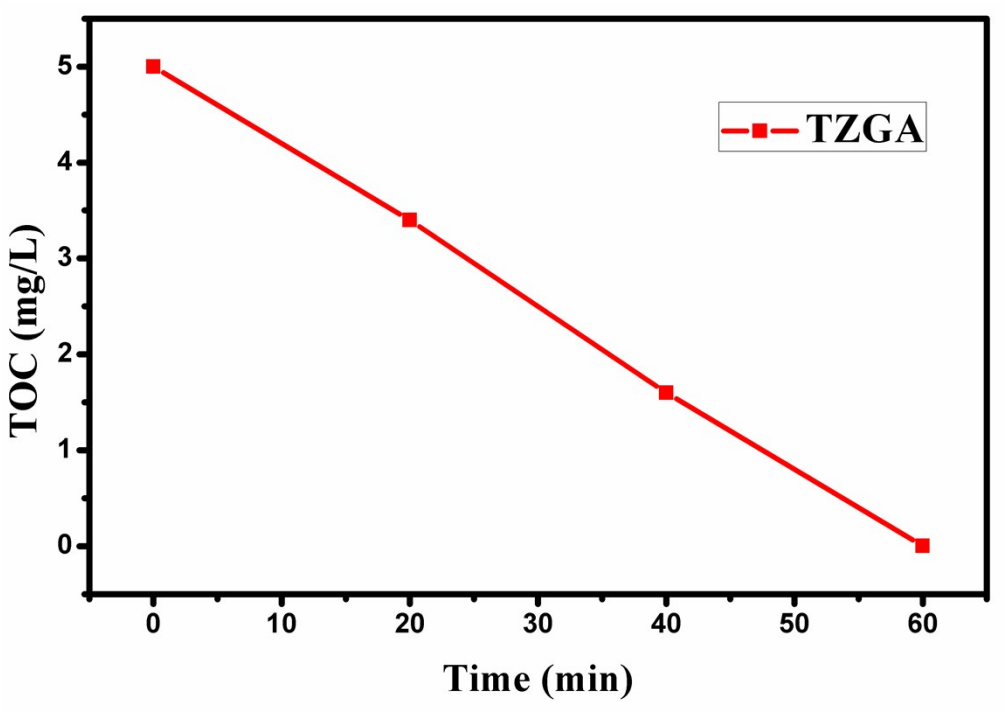

Fig.S5: TOC analysis of TZGA nanocomposite

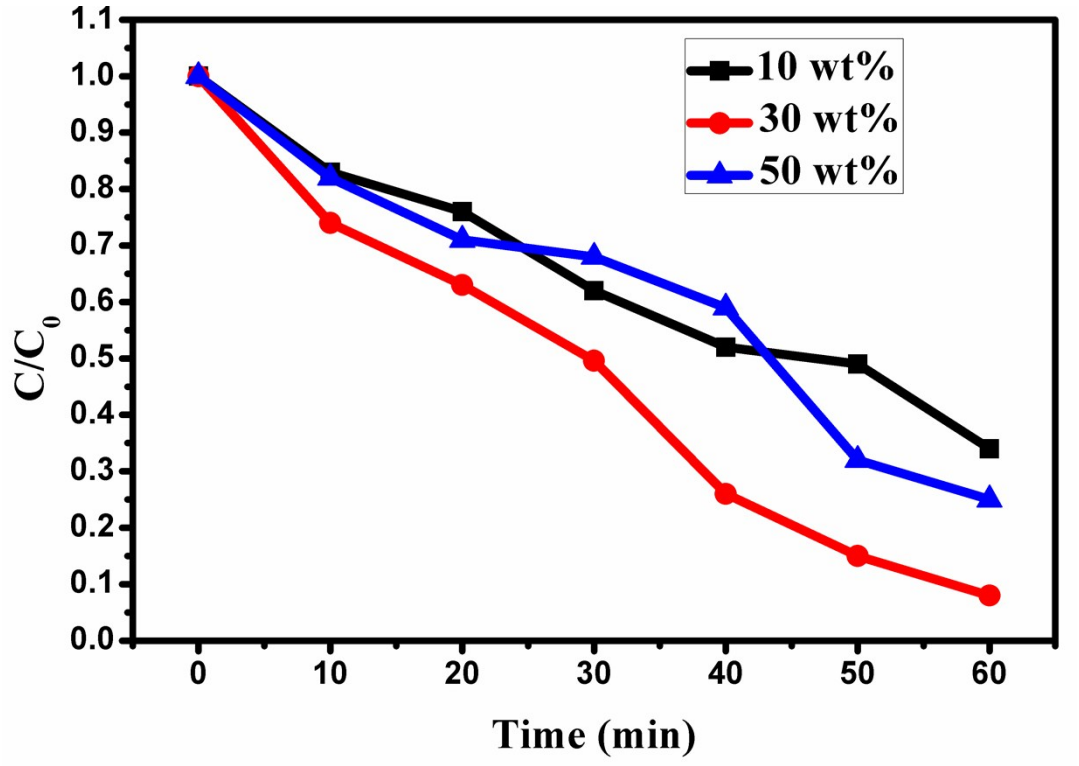

Fig.S6: Photocatalytic degradation of RhB using various compositions of RGO/Ag nanocomposites

References

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