Enhanced photocatalytic dye degradation and hydrogen production ability of $Bi_{25}FeO_{40}$-rGO nanocomposite and mechanism insight

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ABSTRACT

A comprehensive comparison between $Bi_{25}FeO_{40}$-reduced graphene oxide(rGO) nanocomposite and $BiFeO_3$-rGO nanocomposite has been performed to investigate their photocatalytic abilities in degradation of Rhodamine B dye and generation of hydrogen by water-splitting. The hydrothermal technique adapted for synthesis of the nanocomposites provides a versatile temperature-controlled phase selection between sillenite $Bi_{25}FeO_{40}$ and perovskite $BiFeO_3$. Both sillenite and perovskite structured nanocomposites are stable and exhibit considerably higher photocatalytic degradation over pure $BiFeO_3$ nanoparticles and commercially available Degussa P25 titania. Notably, $Bi_{25}FeO_{40}$-rGO nanocomposite has demonstrated superior photocatalytic ability as well as stability under visible light irradiation than that of $BiFeO_3$-rGO nanocomposite. The possible mechanism behind the superior photocatalytic performance of $Bi_{25}FeO_{40}$-rGO nanocomposite has been critically discussed.

Electronic Supplementary Information

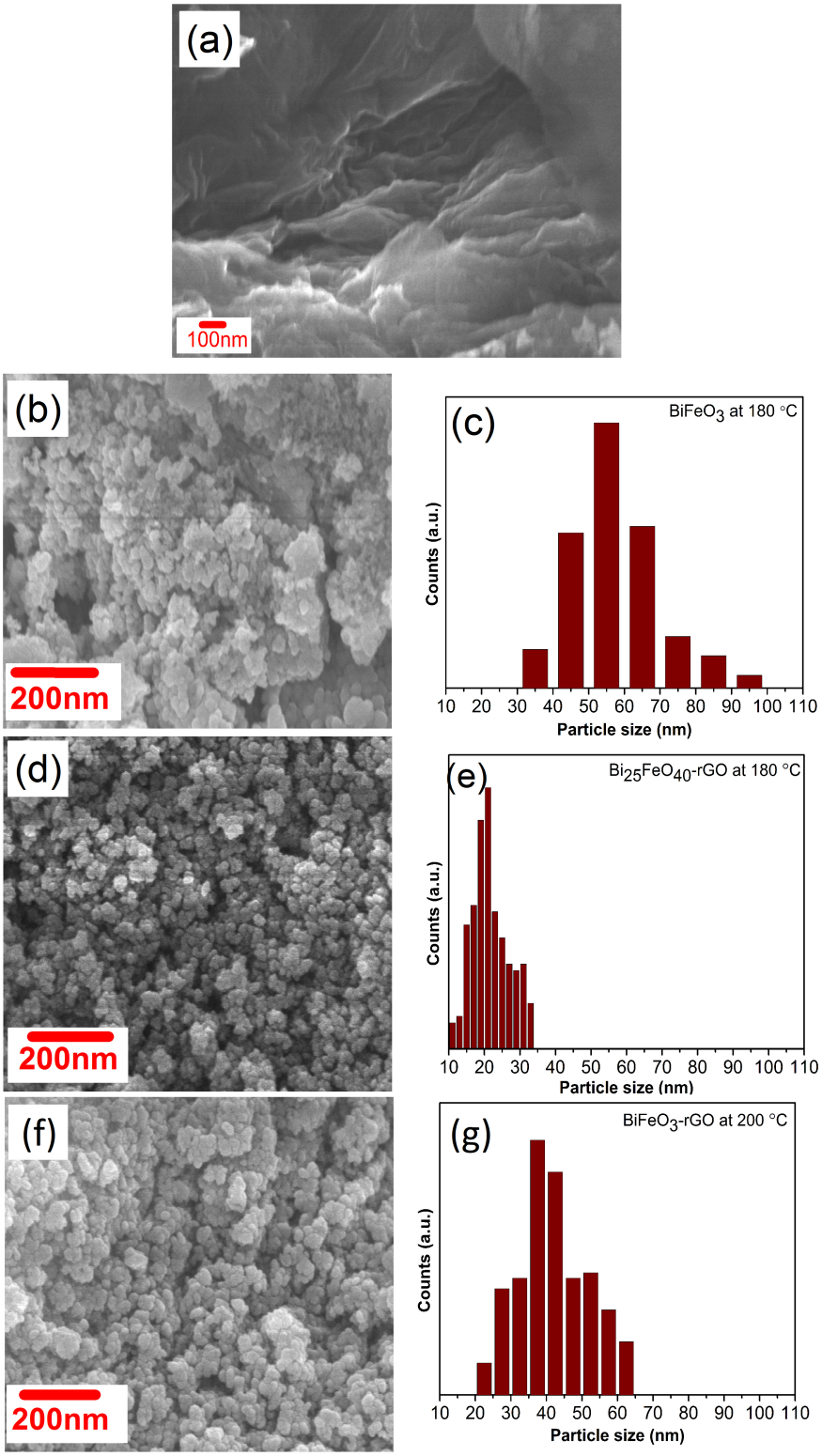

Fig. S1 FESEM images of (a) sheet like structure of GO, (b) perovskite $BiFeO_3$ nanoparticles (c) corresponding histogram of particle size for (b), (d) sillenite $Bi_{25}FeO_{40}$-rGO nanocomposite, (e) corresponding histogram of particle size for (d), and (f) perovskite $BiFeO_3$-rGO nanocomposite; corresponding histogram of particle size for (f) is given in (g) [1]

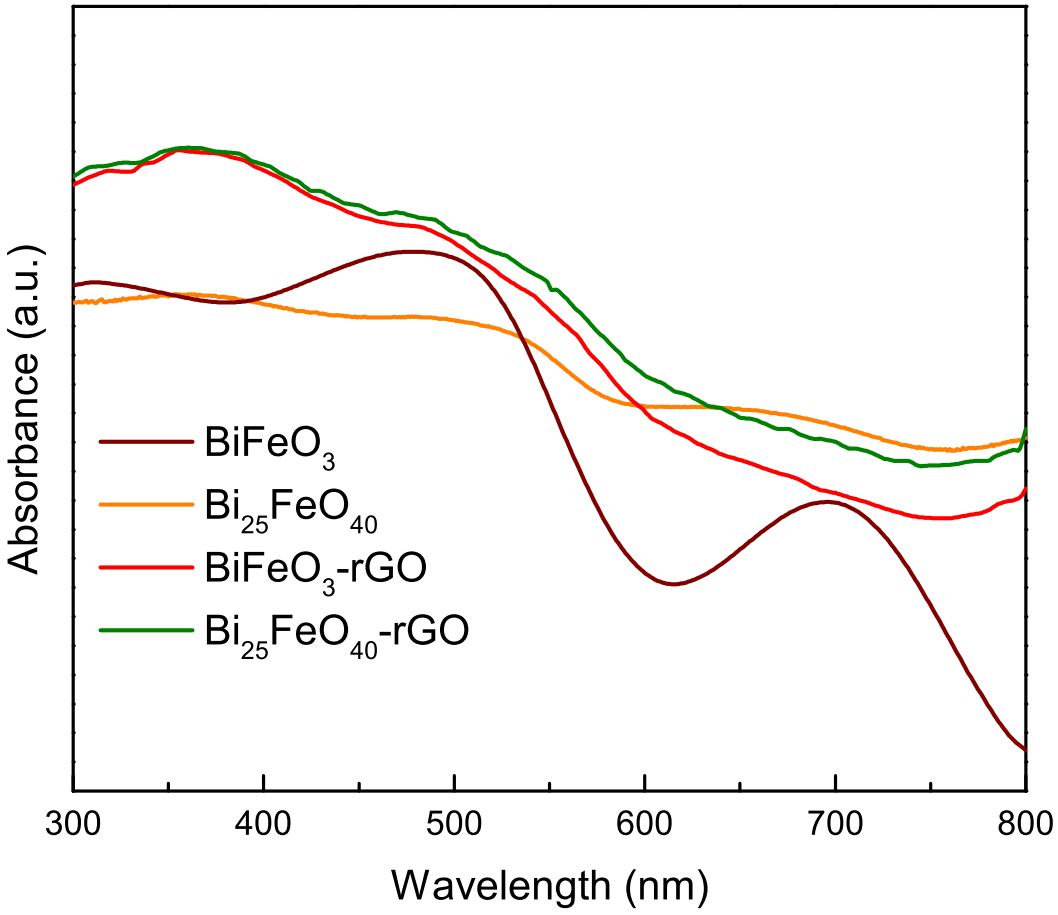

Fig. S2 UV-vis absorbance spectra of $BiFeO_3$ nanoparticles, perovskite $BiFeO_3$-rGO, and sillenite $Bi_{25}FeO_{40}$-rGO nanocomposites

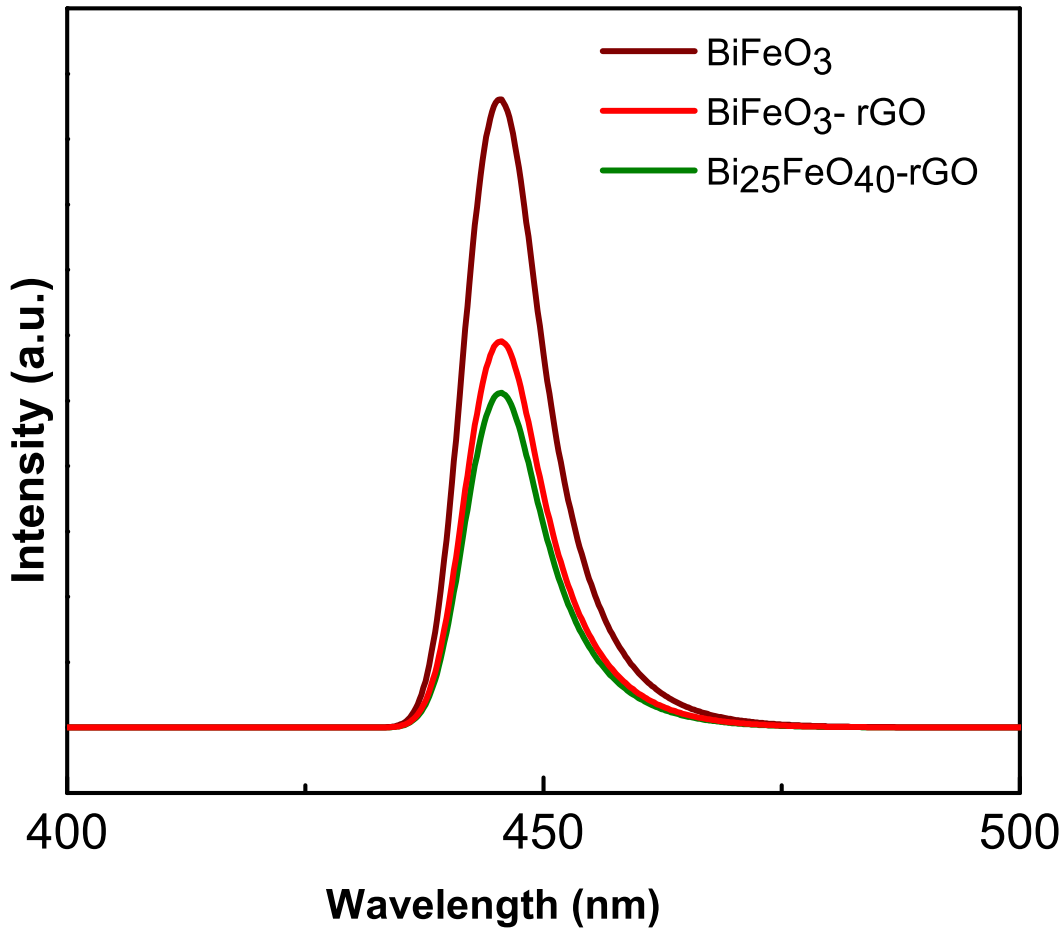

Fig. S3 Steady state PL spectra of $BiFeO_3$ nanoparticles, $BiFeO_3$-rGO nanocomposite and $Bi_{25}FeO_{40}$-rGO nanocomposite

Reference

1. Jalil, M. A. et al. Temperature-dependent phase transition and comparative investigation on enhanced magnetic and optical properties between sillenite and perovskite bismuth ferrite-rGO nanocomposites. Journal of Applied Physics 122, 084902, doi:10.1063/1.4985840 (2017).