Highly efficient photocatalysis by partially reduced graphene oxide (prGO) – zinc oxide composite synthesized via one-pot room-temperature chemical deposition method

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Abstract
Zinc oxide – reduced graphene oxide (ZnO-rGO) composites was synthesized using a one-pot chemical deposition method at room temperature. Zinc dust and graphene oxide (GO) were used as precursors in a mildly alkaline solution. Five GO:Zn ratios were used in the fabrication of ZnO-rGO composites: 1:1 (ZG1), 1:2 (ZG2), 1:5 (ZG3), 1:10 (ZG4), and 1:20 (ZG5). UV-Vis measurements show the fast decomposition of methylene blue (MB) under UV light illumination with the best degradation efficiency of 97.7% within one hour, achieved with sample ZG2. The corresponding degradation rate was k_{ZG2} = 0.1253 min^{-1}. This at least 5.5 times better than other existing work synthesized by hydrothermal and/or sol-gel methods. From the results of XRD, Raman spectroscopy and Thermo-gravimetry and Differential Thermal Analysis (TG-DTA), the excellent photodegradation of MB by ZG2 seems to be due to the efficient charge separation brought about by the presence of rGO, the presence of the mixed phase of GO and rGO, and the formation of a Zn-O-C bond.

Figures

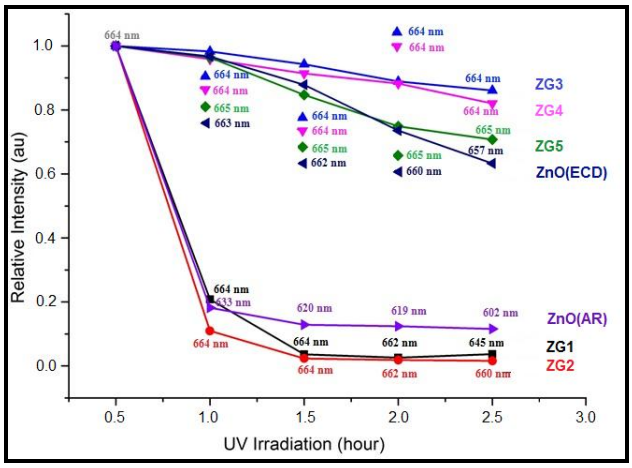

Figure 1: Relative absorbance intensities of ZG1, ZG2, ZG3, ZG4, ZG5, ZnO(ECD) and ZnO(AR) as a function of time of irradiation with UV light.

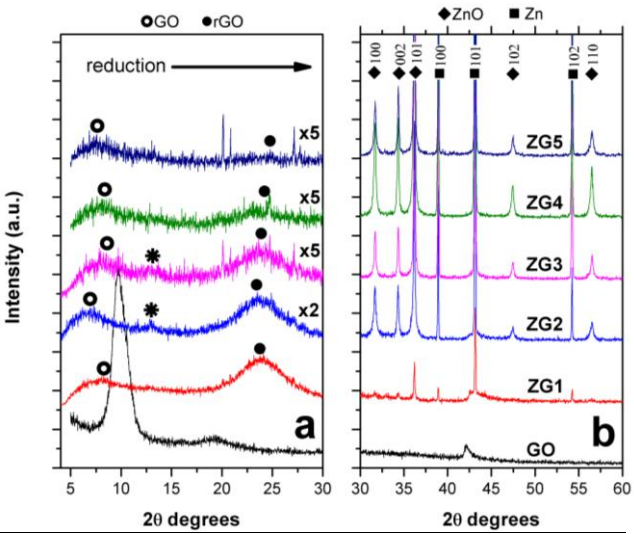

Figure 2: (a) The characteristic peaks for GO ("**O**") and rGO ("●") with increasing Zn content are shown. The spectra for samples ZG2 to ZG5 have been magnified as indicated for clarity. (b) The characteristic spectra for ZnO exhibit a hexagonal wurtzite structure. The peaks for zinc precursor are also present.