Proc. of the Intl. Conf. on Nanotechnology for Better Living, 2016
Editors K. K. Kar, A. Shah and R. Sharma
Vol. 3, No. 1, p. 12
doi:10.3850/978-981-09-7519-7nbl16-rps-12

Enhanced hydrogen production from water by core-shell Au-TiO_2 @graphene oxide nanocomposite under visible light irradiation

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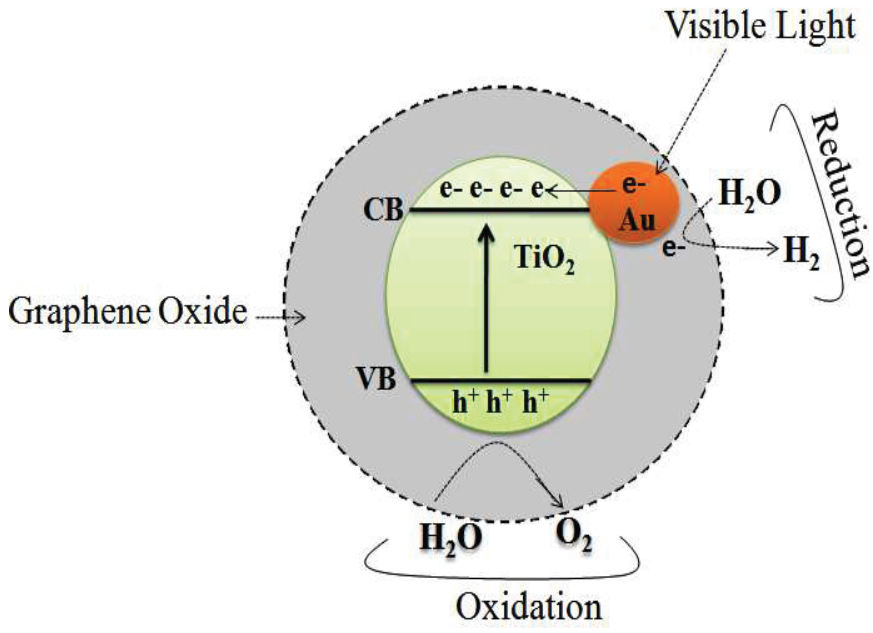
This study signifies the synthesis, characterization and photocatalytic activity for hydrogen production of a graphene oxide based core shell type Au-TiO_2@GO nanocomposite under visible light illumination.

The core shell nanocomposite was synthesized by using a microwave assisted hydrothermal technique. Structural and morphological study shows anatase polymorph of TiO_2 in dominance with oxygen defects on crystal surface, highest specific surface area was observed for Au-TiO_2@GO (100.12 m^2/g) in comparison to Au-TiO_2 (71.32 m^2/g) and TiO_2 (88.33 m^2/g).

A shell of graphene oxide (2.5nm) and expected proportion of Au (0.68 wt %) and C (12.07 w %) was observed in TEM-EDS results. Furthermore, the interfacial property of nanocomposite depicted exponential increase in current with applied voltage similarly time resolved spectroscopy also shows extended electron decay for Au-TiO_2@GO nanocomposite. As shown in scheme 1 Au loading changed the optical response of nanocomposite because of plasmonic effect, higher surface area, larger mobility of electrons and easy transfer from conduction band (CB) of TiO_2 to GO surface (because of its lower reduction potential) resulted in its prominent hydrogen production activity (114 µmol) compared to Au-TiO_2 (45 µmol) and TiO_2 (0 µmol) under visible light irradiation.



Scheme 1: Schematic mechanism of hydrogen production from water on the core-shell Au-TiO_2 @graphene oxide nanocomposite photocatalyst