Graphene based titania catalyst by a facile photoreduction method for dye degradation

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Abstract

Graphene has a layer structure composed of honeycomb network of carbon atoms and can be exfoliated from bulk graphite via different methods such as thermal exfoliation, mechanical cleavage, chemical vapour deposition and chemical functionalization. Because of its superb characteristics, graphene has been utilized in many areas, such as nanoelectronics, optoelectronics, chemical and biochemical sensing, polymer composites, hydrogen production and storage, intercalation materials, supercapacitor, catalysis and photovoltaics. Among the various topics, graphene based photocatalysis is of particular concern. Titania, is known to be a good photocatalyst for the degradation of environmental contaminants due to its higher photocatalytic activity. However the greatest recombination of electrons and holes hinder the application of titania. Graphene, which has a perfect sp^2 hybridized two dimensional carbon structure with better conductivity and larger surface are seems reasonable to envision that graphene-titania photocatalyst with higher interfacial contact and potential could be much more promising to improve the performance of titania. The presence of oxygen containing functional groups in graphene makes them excellent supporters to anchor titania nanocrystals for the synthesis of graphene-titania. In this studies graphene-titania was prepared by a simple photoreduction method using water as solvent and UV irradiation as light source. Colloidal titania solution with graphene dispersed in it was irradiated under UV irradiation in presence of nitrogen gas for 7 hours then dried in an oven at 100^{o}C. The prepared system showed excellent photoactivity in photocatalytic degradation of methyl orange. Characterization of

catalyst revealed the formation of multi-layered graphene with titania nanoparticles embedded on it. X-ray diffraction analysis shows the formation of crystalline anatase phase of titania and the reduction of graphite into graphene.