Contribution ID: **7** Type: **Talk**

Visible light activeTiO2/Au nanorods for photocatalytic environmental remediation

Monday, 4 October 2021 17:15 (15 minutes)

Nanostructured materials exhibit outstanding size/shape dependent properties that make them extremely promising in several application fields. Fundamental features that include (but are not limited to) their optical response, thermodynamic behaviour, plasmonic, magnetic and catalytic properties can be modulated by varying nanocrystal size and shape, without altering their chemical composition.¹ Furthermore, synthesis routes as well as characterization techniques have rapidly evolved thus enabling to rationally design, synthesize, process and organise nanomaterials for specific application fields.¹ In the area of environmental remediation, nanomaterial with photocatalytic properties are gaining increasing attention. In particular, metal/semiconductor thanks to their original photocatalytic properties can be exploited to address several environmental concerns. Indeed, the nanometal moiety can induce the photoactivation of the nanocomposite under visible light irradiation because of several effects, promoted by the Surface Plasmon Resonance (SPR) phenomenon that is strongly size and shape dependent.² The present work, aims at synthesizing a visible light active plasmonic photocatalyst on a gram scale by means of promptly scalable procedure. The synthesis of TiO2/Au NRs hybrid nanocomposites has been performed and their photocatalytic properties investigated. The choice of Au NRs arises from their unique plasmonic properties that enable, to efficiently exploit the UV, Visible and NIR ranges of the solar spectrum. The TiO2/AuNRs nanocomposites have been prepared by a conventional co-precipitation technique and their textural and structural properties have been investigated. The photocatalytic efficiency of the TiO2/AuNRs has been evaluated by carrying out a set of experiments including the photodegradation reactions under UV light irradiation of an organic model compound, Methylene Blue, the photodegradation of the Nalidixic acid as a model real pollutant under visible light irradiation. Finally, the TiO2/AuNRs calcinated at 450℃ resulted to be the most efficient photocatalyst among the investigated nanocomposites, thus holding a great promise as a versatile candidate for real scale applications.³

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Session Classification: Session