Electronic Supplementary Information (ESI) for RSC Advances

Nanostructuring of GNS-V_2O_5/TiO_2 Core/Shell Photocatalyst for Water Remediation Applications under Sun-light Irradiation

R. Ajay Rakkesh, D. Durgalakshmi and S. Balakumar,

National Centre for Nanoscience and Nanotechnology,

University of Madras, Guindy campus, Chennai 600025, India.

Fax: 044-22352494/22353309; Tel: 044-22202749

*E-mail: balasuga@yahoo.com

1. **Photocatalytic degradation of Methylene blue (MB) dye**

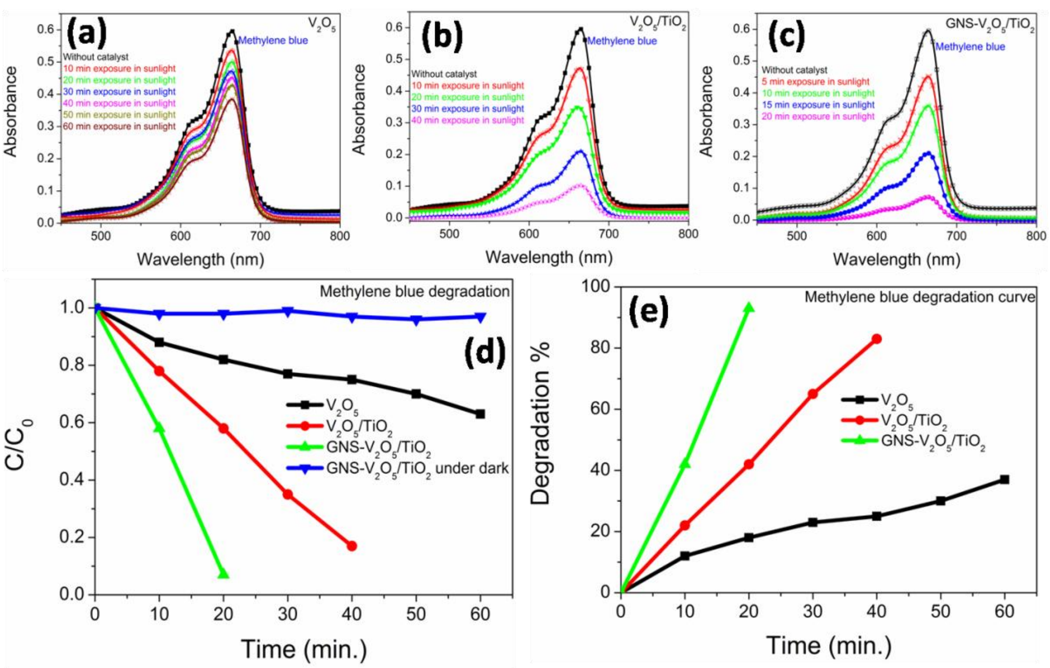

Fig. S1. Photocatalytic degradation of MB using (a) V_2O_5, (b) V_2O_5/TiO_2, (c) GNS-V_2O_5/TiO_2, (d) Initial/residual concentration plot vs time and (e) degradation % of MB vs time.

The UV-Vis-absorption spectra (in Fig. S1 (a-c)) showed the MB degradation plot versus time with V_2O_5, V_2O_5/TiO_2, GNS-V_2O_5/TiO_2 nanoarchitecture photocatalysts, respectively. C/C_0 spectra indicate that the 2.5×10^{-5} M concentration of MB dye was decomposed of about 37% for pure V_2O_5 nanorods within 60 minutes, 83% for V_2O_5/TiO_2 core/shell nanorods within 40 minutes and 93% for GNS-V_2O_5/TiO_2 nanoarchitectures within 20 minutes (in Fig. S1 (d and e)) under direct sunlight irradiation. GNS-V_2O_5/TiO_2 nanoarchitectures exhibited higher photocatalytic efficiency than that of the pure and core/shell nanomaterials. This result demonstrates that GNS enhances the photocatalytic activity of V_2O_5/TiO_2 core/shell nanorods under direct sunlight irradiation.

2. Nitrogen adsorption-desorption isotherm

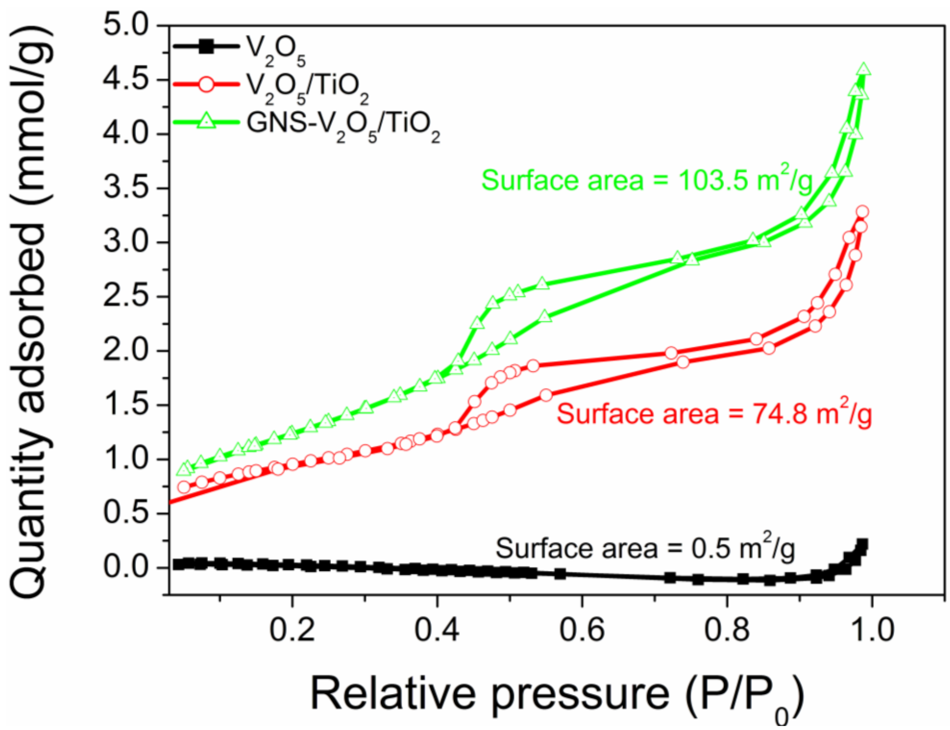

Fig. S2. Nitrogen adsorption – desorption isotherm of V_2O_5, V_2O_5/TiO_2 and GNS-V_2O_5/TiO_2 nanoarchitecture photocatalysts

To explore the specific surface area of V_2O_5, V_2O_5/TiO_2 and GNS-V_2O_5/TiO_2 nanoarchitecture photocatalysts, nitrogen adsorption-desorption investigations have been carried out. The BET surface area characteristic of these nanoarchitecture are shown in Fig. S2. Both adsorption and desorption curves demonstrate type IV curve characteristics. The surface area of GNS-V_2O_5/TiO_2 is determined to be 103.5 m^2/g by fitting the isotherms to the BET model. This value is significantly higher than that of V_2O_5/TiO_2 (74.8 m^2/g) indicating that graphene nanosheets have a better structure suitability due to their two dimensional nanostructures. Therefore, there are higher contact area between GNS and V_2O_5/TiO_2 core/shell nanostructure. These results evidently highlight that the V_2O_5/TiO_2 core/shell nanostructures are homogeneously anchored on GNS layers.

3. HRSTEM fringes of V_2O_5/TiO_2 core/shell nanostructures

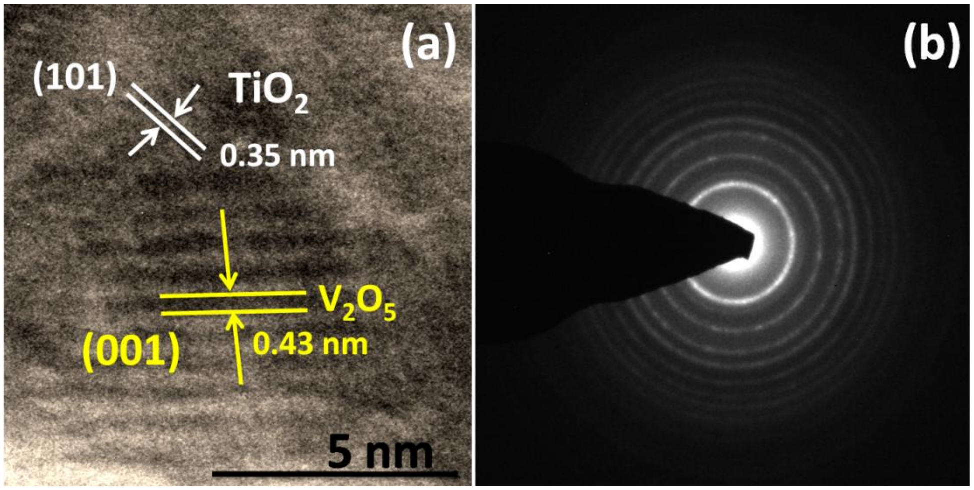

Fig. S3. HRSTEM lattice fringes of V_2O_5/TiO_2 core/shell nanostructures

The HRSTEM fringes pattern of V_2O_5/TiO_2 core/shell nanorods for better understanding. The V_2O_5/TiO_2 core-shell nanorod interface exhibits a strong alignment of the two different crystal lattices, resulting in the electrostatic interaction of TiO_2 on V_2O_5 nanorods to form a core/shell like structure. The measured lattice distance of 0.43 nm corresponds to the (001) plane of orthorhombic V_2O_5 nanorods. We have also observed the lattice fringes of 0.35 nm, which correspond to the interplanar distance of (101) plane of the anatase TiO_2 (in fig. S3 (a)). The SAED pattern reveals the diffraction rings are polycrystalline nature (in fig. S3 (b)).