Synthesis and characterization of reduced graphene oxide-modified anatase TiO_2 photocatalysts grown by MOCVD

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Inadequate disposal of industrial waste, such as textile dyes and emerging contaminants, have been caused several environmental hazards. Titanium dioxide (TiO_2) photocatalysis is an efficient green method for water treatment by solar energy. However, due to its large band gap of 3.2 eV, TiO_2 absorbs mostly the UV radiation, which represents only 5-8% of the sunlight spectrum. Recent studies indicate that the surface modification of TiO_2 results in an increase in photocatalytic efficiency. In this way, the present paper aims to evaluate the effects of TiO_2 surface modification by reduced graphene oxide (rGO). The 470 nm thick anatase-TiO_2 films were grown by MOCVD process in a conventional horizontal homemade reactor, on borosilicate substrates at 400 °C. The TiO_2 films obtained were dipped into an alkoxide solution including 0.5, 1.5 and 3.0 mg of rGO and 30 mL isopropanol, ultrasonic-treated at room temperature for 40 min, and then dried in an oven at 100 and 150 °C for 24 h. The photocatalytic activity of rGO-TiO_2 composites were evaluated by the methylene blue degradation under UV and visible light. The chemical, structural and morphological properties were also characterized. It was observed the presence of rGO agglomerates completely adhered to TiO_2 surface. The diffraction peaks identified correspond to anatase phase. Peaks of graphene were also found. The results suggest that the rGO-TiO_2 composites have a great potential to be used in water treatment under sunlight.