Synthesis of GO/TiO_2 composite through hydrothermal method for photocatalytic application

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Abstract

Heterogeneous photocatalysis is a technology that combines a source of appropriate light and a solid semiconductor material as catalyst in order to promote chemical reactions by means of the generation of electron-hole pairs. TiO_2 is the most popular catalyst; however, the photocatalytic activity of this compound is limited because i) energy is absorbed mainly in the UV region of the solar spectrum, ii) the rapid recombination of photogenerated electron-hole pairs in TiO_2 nanoparticles and iii) the difficult contact between the catalyst and the contaminant [1]. Therefore research on new materials that overcome these drawbacks, among them graphene oxide (GO), is a scientific and technical challenge nowadays [2].

In this work, GO/TiO_2 nanocomposites were prepared and used as photocatalyst for water treatment by blending TiO_2 with graphene oxide (GO/TiO_2) through hydrothermal synthesis. Nanocomposites were characterized by atomic force microscope (AFM), thermogravimetric analysis (TGA), Brunauer-Emmet-Teller (BET) surface area and Fourier-transformed infrared spectroscopy (FT-IR). Dichloroacetic acid (DCA) was used as probe in order to assess the photocatalytic activity through its mineralization.

AFM image illustrates that the height profiles showed 2nm thickness GO nanoplatelets decorated with TiO_2 nanoparticles of an average diameter of 16nm (Figure 1). The TGA results show that the composite is more stable than the GO due to the embedded TiO_2, which delays the weight loss. The BET analysis demonstrates that the synthesized composite has greater surface area than commercial TiO_2 and finally, FT-IR spectroscopy showed that GO is significantly reduced during the synthesis process. Furthermore, the results highlight that GO is not active as independent catalyst and using the composite the photocatalytic activity is improved because 31.6% mineralization was achieved after three hours of experiment while only 15% mineralization was obtained with titanium dioxide as catalyst.

References

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Figures

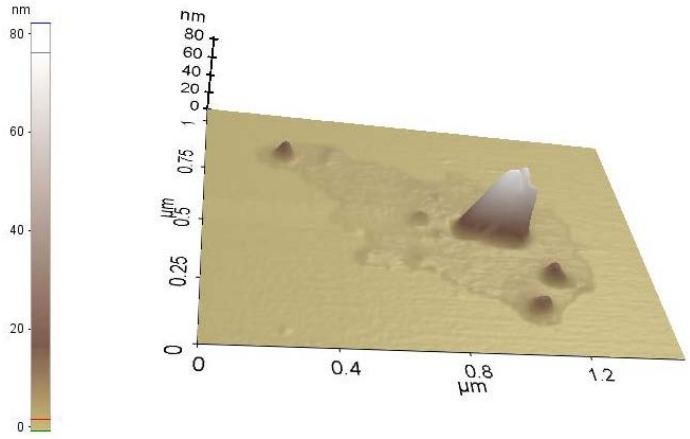

Figure 1. Non contact mode AFM images of GO/TiO_2 composite synthetized by hydrothermal method