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Synthesis and characterization of Cu:TiO_2 photocatalysts with suitable optical properties

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Extended Abstract

The use of Cu has attracted much attention in the scientific field as a means of improving the photocatalytic activity of TiO_2. This has been driven by its low cost, compared to noble metals (Au, Ag, Pt and Pd) and its high availability. Therefore, several applications in photocatalytic processes have been proposed [1-5].

In this context, this research project presents the development of a method for the synthesis of copper-doped titania photocatalysts (Cu:TiO_2) that meet the required optical and physicochemical characteristics for their future application in photocatalytic processes. The photocatalysts were synthesized by modifying some parameters (temperature, time, different solvents, use of ultrasound and metal content) of the incipient impregnation technique [6].

The physicochemical properties of the photocatalysts were correlated with respect to the parameters incorporated of the synthesis method and the metal content (0.5, 1.0 and 1.5 % w/w). Thermal analysis, such as Thermogravimetric Analysis (TGA) and Temperature Programmed Reduction (TPR) were performed to determine the decomposition temperature of the precursor salt and the reduction temperature of Cu, respectively. The particle size distribution, the crystallographic study and the bandgap values were obtained by means of analytical techniques of Transmission Electron Microscopy (TEM), X-Ray Diffraction (XRD), UV-vis diffuse reflectance spectroscopy, respectively.

The results demonstrate that the developed synthesis method does favour the reduction of the bandgap of titania, from 3.2 eV to 3.02 eV for the photocatalyst with the highest metal content (1.5 % w/w Cu:TiO_2). This was evidenced by the study of the crystalline structure of the synthesized photocatalysts, since it was shown that the incorporation of Cu modified the values of the lattice parameters for all the samples. In addition, it was observed that the parameters involved in the synthesis process, such as the use of water or alcohol as a solvent and the use of ultrasound influenced the optical properties of the synthesized photocatalysts.

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