Raman spectroscopy applied on the structural characterization of TiO_2/expanded graphite films

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Photocatalytic heterojunctions obtained from the use of titanium dioxide (TiO_2) and carbon-based materials are a promising way for the efficient water treatment [1]. The structural properties of the composite photocatalysts are an important characteristic that can influence their photocatalytic behavior [2]. Here, TiO_2/expanded graphite (TiO_2-EG) films were synthetized by sol-gel and deposited on borosilicate glass substrates by airbrush spray coating method at room temperature. Then, the hybrid films were heat treated at 350, 450 and 550 ℃. Raman spectroscopy technique was applied to evaluate the effect of carbon amount and temperature on the structural properties of the films. The films heat treated at 350 ℃ exhibited a characteristic profile of amorphous material. Raman spectra of composite films heat treated at 450 and 550 ℃ showed well-defined peaks that can be attributed to anatase-TiO_2phase. No peaks related to the rutile or other phases were observed. The investigation revealed that the G and 2D bands present a slight shift, as well as asymmetry, as the carbon content and heat treatment temperature increase - behavior that may be associated with the formation of the semiconductor-C heterojunction. Peaks deconvolution process demonstrated the presence of a second signal not found in the pure films. This effect may indicate a reduction of sp^2domains after the formation of semiconductor-C heterojunction, mainly due to the removal of oxygenated groups during heat treatment, and consequent Ti-C / Ti-O-C bonds formation [3]. The results suggested that the carbon amount and the temperature of heat treatment have great influence on the TiO_2 -EG structural properties, which may contribute to the improvement of the photocatalytic activity of the composite films under visible light.

References:

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