Rare earth doped metal oxide nanostructures as photocatalysts for pollutants degradation

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Abstract

Recently, there is a significantly increased interest for the development of new oxide semiconductor materials due to their use in various applications such as photocatalysts, batteries, self-cleaning surfaces, fabrics, photovoltaics, cosmetics, antiseptic patches, drug delivery systems, components of sunscreen as well as ink and paints. Also, nanostructured oxide semiconductor materials are intensely used in environmental protection and purification. This work will focus on our recent achievements in the preparation and use of composite materials based on pure and rare earth (RE) doped ZnO and TiO_2 in photocatalytic degradation processes of various organic pollutants (dyes and drugs). Various composites developed by electrospinning followed by calcination at different temperatures and their properties will be presented and discussed. These nanostructures have been fabricated using low-cost and easily scalable methods, which lead to materials with remarkable photocatalytic activity for the degradation of a large number of common water pollutants. Typical results regarding the characterization of nanocomposite materials included: X-ray diffraction (XRD), scanning electron microscopy (SEM), and ultraviolet-visible spectroscopy (UV-Vis), as well as photocatalytic degradation of various organic pollutants under UV-Vis light irradiation, were performed. Moreover, the enhancement of photocatalytic activity by fine-tuning the morphology, structure and optical properties were also highlighted. Thus, it was demonstrated that the photocatalytic performances of these materials can be improved by doping with different rare earths [1-4]. These new materials showed remarkable photocatalytic activities under optimal photodegradation conditions with rate constants of 10^{-1} min^{-1}. In addition, the photocatalysts showed excellent reusability even after several cycles of use, tested under identical conditions.

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