The promoting effect of MgO layer in sensitized photodegradation of colorants on TiO_2/MgO composite oxide

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Abstract

The promoting effects of MgO layer on TiO_2 catalyst for the sensitized degradation of colorants in aqueous phase has been investigated. As explained in literature, our results indicate that both dye adsorption amount and the equilibrium constant increase after coating TiO_2 with a MgO layer and the photocatalytic activity is highly dependent on the thickness of the MgO layer. In this report, using charge transfer studies, we propose that the dye adsorption amount might not be the rate-limiting step, but the slow charge recombination on TiO_2/MgO leads to higher dye degradation on TiO_2/MgO composite catalyst. We show that the MgO layer on TiO_2 retards the charge recombination resulting in higher dye degradation in the absence of a suitable redox couple. It was shown that the thin layer of insulating MgO on TiO_2 acts as a barrier for charge recombination and charge recombination rates were progressively reduced with the MgO amount present on TiO_2. Therefore, the promoting effect of MgO layer on TiO_2 could also be attributed to slow charge recombination in addition to enhanced dye adsorption amount. The use of such systems in dye-sensitized solar cell is discussed.

Keywords: TiO_2; MgO; Charge recombination; Photodegradation; Eosin