

Photocatalytic Degradation of Methyl Orange by Ag Doped $\text{La}_2\text{Ti}_2\text{O}_7$

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Abstract : Photocatalytic degradation is an appealing process to remove organic contaminants from industrial wastewater, but usually impeded by less effective photocatalysts. Here, we successfully synthesized Ag doped $\text{La}_2\text{Ti}_2\text{O}_7$ via a simple sol-gel route for photocatalytic methyl orange (MO) degradation. Their crystal structures, morphology, surface area and optical absorption activity were systematically characterized by X-ray diffraction, scanning electron microscope, BET N_2 adsorption-desorption study, and UV-vis diffuse reflectance spectra. The photocatalytic activity was evaluated by MO photodegradation under a 300 W xenon lamp. The results indicate that the doping of Ag has effectively narrowed the band gap, increased the specific area of $\text{La}_2\text{Ti}_2\text{O}_7$, and suppressed the recombination of photogenerated carriers. Compared with the pristine $\text{La}_2\text{Ti}_2\text{O}_7$, $\text{La}_{1.9}\text{Ag}_{0.1}\text{Ti}_2\text{O}_7$ revealed a superior performance for MO degradation with a degradation rate of 97% in only 60 min. Also, the pseudo-first order kinetic constant for $\text{La}_{1.9}\text{Ag}_{0.1}\text{Ti}_2\text{O}_7$ is ~ 11 times higher than that of undoped sample. The outstanding performance of Ag modified $\text{La}_2\text{Ti}_2\text{O}_7$ is probably attributed to the integrated factors. Active species trapping experiments indicated that h^+ plays a critical role in MO degradation, while $\bullet\text{O}_2^-$ has slight effect on the photocatalytic activity and the function of $\bullet\text{OH}$ can almost be neglected.

Keywords : Ag doped $\text{La}_2\text{Ti}_2\text{O}_7$, methyl orange, photodegradation, surface plasmon resonance

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