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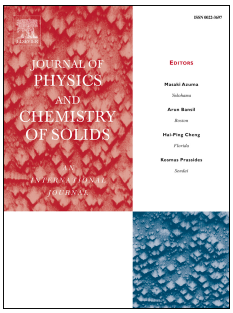

Visible photocatalytic degradation of methylene blue on magnetic $SrFe_{12}O_{19}$

Debesh Devadutta Mishra, Guolong Tan

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Visible Photocatalytic Degradation of Methylene Blue on Magnetic $SrFe_{12}O_{19}$

Debesh Devadutta Mishra, Guolong Tan[*]

State Key Laboratory of Advanced Technology for Materials Synthesis and Processing, Wuhan University of Technology, Wuhan 430070, China

Abstract

Methylene blue (MB) is representative of a class of dyestuffs that are resistant to biodegradation. In this study, MB was degraded in an aqueous suspension of $SrFe_{12}O_{19}$ powder under visible illumination. $SrFe_{12}O_{19}$ is a type of traditional magnet and its semiconductor characteristics were elucidated based on the ultraviolet-visible spectrum. The direct and indirect bandgap energies were determined as 1.70 eV and 0.83 eV, respectively. This magnetic compound exhibited excellent photocatalytic activity during the degradation of MB. The color of the MB solution gradually changed from deep blue to pale white as the duration of the photodegradation reaction increased, and the absorption intensity decreased rapidly to zero. However, five absorption bands did not exhibit any blue shifts during the reaction period, thereby suggesting that the degradation of MB was completed in a one-step manner, which makes $SrFe_{12}O_{19}$ a unique magnetic catalyst that differs from TiO_2 and other conventional catalysts.

Keywords: Magnetic semiconductor, Methylene blue, Optical property, Photodegradation, $SrFe_{12}O_{19}$

1. Introduction

The contamination of water by organic pollution is a problem that affects water quality and public health because of toxic effects on the human body even at very low concentrations. Therefore, the reactive dyes produced by dyeing processes require appropriate treatment before their discharge into the environment [1]. Several strategies have been developed to minimize pollution such as by eliminating pollutant sources via biological treatment, membrane separation, adsorption on activated carbon, and photocatalytic degradation [2-4], which has the advantage of degrading many organic contaminants into carbon dioxide and water under sunlight [5, 6]. Due to its low toxicity, abundance, high photostability, and high efficiency, titanium dioxide is the most widely used catalyst for degrading pollutants in the

[*] *Corresponding author: gltan@whut.edu.cn*