Int. J. Electrochem. Sci., 16 **(2021)** Article ID: 21023

International Journal of
ELECTROCHEMICAL
SCIENCE
www.electrochemsci.org

Electrochemical and Photocatalytic Properties of Ru-doped TiO_2 Nanostructures for Degradation of Methyl Orange Dye

Baoshan Gong[1,2], Pei Wu[1,2,], Jia Yang[1,2], Xuanwei Peng[1,2], Hongwen Deng[1,2], Gaohong Yin[1,2]*

[1] School of Civil Engineering and Architecture, Chongqing University of Science and Technology, Chongqing 401331, China
[2] Chongqing Xin Yun Chuang Institute of Environmental Protection Research Co. Ltd, Chongqing 402566, China
[*]E-mail: wplw666@126.com

doi: 10.20964/2021.02.18

Received: 1 October 2020 / *Accepted:* 25 November 2020 / *Published:* 31 December 2020

This study was focused on chemical synthesis of the pure TiO_2 nanorods and Ru-doped TiO_2 nanorods and their applications as photocatalyst for photodegradation of the methyl orange (MO) dye under UV and visible irradiations. The morphology, crystallinity, optical, electrochemical and photocatalyst properties of prepared films were characterized by FESEM, XRD, UV-visible absorption, electrochemical impedance spectroscopy (EIS) and photodegradation analyses. The FESEM and XRD studies showed both of films were synthesized in nanorod shape and anatase crystal phase. The optical studies indicate that the optical band gap values were obtained 3.37 eV and 3.22 eV for nanostructured pure TiO_2 and Ru-doped TiO_2 films, respectively. EIS analysis indicates that Ru-doped TiO_2 film exhibited lower recombination rate of photo-excited carriers through effective separation of the photogenerated electron-hole pairs. Photodegradation studies of MO show that the degradation rate significantly was improved by Ru doping and the complete removal of MO were obtained after 55 and 45 minutes under UV and sunlight irradiation, respectively. While, degradation efficiency of MO on pure TiO_2 photocatalyst were achieved 57.0 % and 4.8 % after 60 minutes UV and sunlight irradiations, respectively. Therefore, the photodegradation rate of doped film was remarkably enhanced under both UV and sunlight irradiations. Moreover, photocatalytic activity was remarkably promoted under sunlight on doped photocatalyst because of narrowing optical band gaps.

Keywords: Photodegradation; Methyl orange dye; Ru-doped TiO_2; Electrochemical impedance spectroscopy; Degradation efficiency

FULL TEXT