Photocatalytic performance of SiO$_2$-TiO$_2$ composite via F-assisted restructure of Ti-bearing slag

Jizhi Zhou, Hao Hou, Mao Lin, Yongwen Su, Yongsheng Lu, Jia Zhang*, Guangren Qian

School of Environmental and Chemical Engineering, Shanghai University, No.99 Shangda Rd., Shanghai 200444, China,
email: jizhi.zhou@t.shu.edu.cn (J. Zhou), majestic@i.shu.edu.cn (H. Hou), lm0813@yeah.net (M. Lin), 965957410@qq.com (Y. Su),
Tel. +862166137746. Fax +86 21 66137761, email: irujam@t.shu.edu.cn (J. Zhang), email: 273918409@qq.com (G. Qian)

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ABSTRACT

In this work, the formation of SiO$_2$ coated TiO$_2$ (SiO$_2$-TiO$_2$) composite from titanium bearing blast furnace slag (TBBFS) was carried out by hydrothermal treatment in the acidic solution with the assistance of F$^-$. The basanite and perovskite were two main compositions in TBBFS which provided Si and Ti for the SiO$_2$-TiO$_2$ composite formation, respectively. For this purpose, the HCl solution was used as leaching agent in the hydrothermal treatment of TBBFS at 180°C, which led to Si and Ti leaching for the formations of anatase TiO$_2$ phase and amorphous SiO$_2$ phase. In comparison, the leaching process in HF led to the formation of metal fluorides and TiO$_2$ with the dissolution of most Si. Accordingly, different amount of HF addition in HCl leaching of TBBFS led to the SiO$_2$ / TiO$_2$ mass ratio in composite varying from 1.1 to 3.7. Moreover, the various mass ratio of SiO$_2$ to TiO$_2$ in the composite resulted in the different photodegradation performance of Rhodamine B, where 95% of Rhodamine B was removed on the composite at 1.1–1.2 of SiO$_2$ / TiO$_2$ mass ratio. The adsorption of positive dye on negative SiO$_2$ and the simultaneous photodegradation on available TiO$_2$ surface were responsible for the effective Rhodamine B removal. Therefore, our result provided a facile approach to the preparation of photocatalyst candidate from TBBFS for the degradation of organic contaminant in the solution.

Keywords: Titanium bearing blast furnace slag; Hydrothermal treatment; Anatase; Photocatalyst

*Corresponding author.