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## 钽掺杂金红石型二氧化钛光催化分解水的析氧活性

吴道新<sup>1, 2</sup>, 陈启元<sup>1</sup>, 李 洁<sup>1</sup>, 尹周澜<sup>1</sup>

(1. 中南大学 化学化工学院, 长沙 410083;  
2. 长沙理工大学 化学与生物工程学院, 长沙 410077)

**摘 要:** 以钛酸丁酯为原料, 用低温超声水解方法合成不同Ta掺杂浓度的金红石型TiO<sub>2</sub>光催化剂, 采用XRD、PL、DRS、BET等技术进行了催化剂表征。在光源为高压汞灯和氙灯、Fe<sup>3+</sup>为电子受体、悬浮液pH值为2.0的条件下, 考察Ta掺杂对金红石型TiO<sub>2</sub>的光催化分解水析氧活性的影响。结果表明: Ta掺杂量(质量分数)在1.0%~5.0%范围时, Ta掺杂没有改变金红石型TiO<sub>2</sub>的晶型, 表面形成氧空位, 在导带底附近形成施主能级, 有利于光生电子和空穴的分离, 掺杂催化剂光致发光强度与其光催化析氧活性的变化趋势一致; 当Ta掺杂量在1.0%时, 掺杂催化剂的光催化分解水析氧活性最高, 紫外光和可见光下光催化分解水的析氧速率分别为130.4和69.6 μmol/(L·h), 比金红石型TiO<sub>2</sub>掺杂改性前的析氧速率分别提高14.6%和12.1%。

**关键字:** 金红石型TiO<sub>2</sub>; 掺杂钽; 光催化分解水; 析氧

## Photocatalytic oxidation of water to O<sub>2</sub> over Ta-dopant of rutile TiO<sub>2</sub>

WU Dao-xin<sup>1, 2</sup>, CHEN Qi-yuan<sup>1</sup>, LI Jie<sup>1</sup>, YIN Zhou-lan<sup>1</sup>

(1. School of Chemistry and Chemical Engineering, Central South University, Changsha 410083, China;  
2. School of Chemistry and Biological Engineering, Changsha University of Science and Technology, Changsha 410076, China)

**Abstract:** The photocatalyst of Ta-doped rutile TiO<sub>2</sub> with different Ta doping concentrations were prepared by low temperature ultrasonic hydrolysis using tetrabutyl titanate(C<sub>16</sub>H<sub>36</sub>O<sub>4</sub>Ti) as raw material. This photocatalyst was characterized by XRD, PL, DRS and BET. Under the condition of Fe<sup>3+</sup> as electron acceptor, pH=2.0 with UV irradiation and visible radiation, the effects of various Ta doping concentrations on the photocatalytic oxidation activity of Ta doped rutile TiO<sub>2</sub> particles were investigated. The results show that with appropriate concentration ranging in 1.0%–5.0%, Ta can be doped into rutile TiO<sub>2</sub> lattice without causing any change in rutile TiO<sub>2</sub> crystal structure. Therefore, the surface oxygen vacancies and

the donor energy level near the bottom of the conduction band lead to easier departure of photoinduced electrons from holes to achieve stronger photocatalytic activity. The highest photocatalytic oxygen evolution and PL Spectra intensity are achieved. When the concentration of Ta is 1.0%, the O<sub>2</sub> evolution speeds are 130.4 and 69.6 umol/(L·h) under UV irradiation and visible radiation, which are 14.6% and 12.1% higher than those before doping, respectively.

**Key words:** rutile titania; Ta-doped; photocatalytic water splitting; oxygen evolution

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地 址：湖南省长沙市岳麓山中南大学内 邮编： 410083

电 话： 0731-8876765, 8877197, 8830410 传真： 0731-8877197

电子邮箱： f-ysxb@mail.csu.edu.cn