

La₅Ti₂Cu_{0.9}Ag_{0.1}O₇S₅ 粉末に対する CdS 修飾が光触媒的水素生成活性に与える影響

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Effects of CdS modification for La₅Ti₂Cu_{0.9}Ag_{0.1}O₇S₅ on photocatalytic hydrogen evolution activity (¹*Faculty of Engineering, Shinshu University*, ²*Research Initiative for Supra-Materials, Shinshu University*, ³*The University of Tokyo*) ○Haruto Yonehara,¹ Ryunosuke Iwaya,¹ Yosuke Kageshima,^{1,2} Katsuya Teshima,^{1,2} Kazunari Domen,^{2,3} Hiromasa Nishikiori^{1,2}

It is known that modification of CdS, an n-type semiconductor, on the surface of a photocathode consisting of a p-type semiconductor can significantly improve the photoelectrochemical properties.¹⁾ However, there are few reports of activity enhancement by p-n junction formation in the case of photocatalytic powder suspension systems.

In this study, we aimed to improve the photocatalytic hydrogen evolution activity of the powder suspension systems by modifying the p-type semiconducting La₅Ti₂Cu_{0.9}Ag_{0.1}O₇S₅ (LTCA) with CdS. CdS was modified by the impregnation and sulfurization method, whereas Pt cocatalyst by the impregnation and hydrogen reduction. The dependence of the hydrogen production rate of Pt/CdS/LTCA on the amount of CdS modifier is shown in Fig.1. The maximum hydrogen production activity was observed when the modification amount was 1 wt%. However, the activity is still lower than that of unmodified LTCA, suggesting that the modification method needs to be improved. In the presentation, the effects of various CdS modification methods on the activity and physical properties will be discussed in detail.

Keywords : Photocatalysts, Hydrogen evolution, Oxysulfide, Surface modifications, Powder

p 型半導体から成る光カソード表面に、n 型半導体である CdS を修飾することで、光電気化学特性が大幅に向上することが知られている¹⁾。しかし、光触媒粉末懸濁系においては p-n 接合形成による活性向上の報告例はほとんどない。

本研究では、p 型半導体である La₅Ti₂Cu_{0.9}Ag_{0.1}O₇S₅ (LTCA) 光触媒粉末に CdS を修飾することで、粉末懸濁系における光触媒的水素生成活性の向上を目指した。含浸・硫化法によって CdS を、含浸・水素還元法によって Pt 助触媒を修飾した。Pt/CdS/LTCA の水素生成速度の CdS 修飾量依存性を Fig.1 に示す。修飾量が 1wt% のときに最大の水素生成活性を示した。しかし、CdS 未修飾の場合に比べ活性は低下しており、修飾方法の改善が必要と考えられる。発表では種々の CdS 修飾方法が活性・物性に与える影響についても議論する。

1) M. Moriya, et. al., *J. Am. Chem. Soc.* **2013**, *135*, 3733–3735.

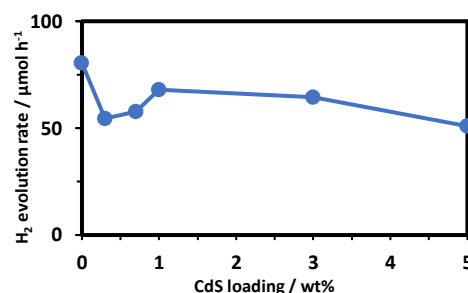


Fig.1. The dependence of the H₂ evolution rate on the amount of CdS loaded on the Pt/CdS/LTCA photocatalyst.