光照射下の水系懸濁液中における光触媒近傍の温度が水素生成速度に与える影響

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Effects of Temperature near the Photocatalyst under Light Illumination in Aqueous Suspension on Hydrogen Evolution Rate ([1]*Faculty of Engineering*, *Shinshu University*, [2]*Research Initiative for Supra-Materials*, *Shinshu University*) ○ Mika Hirata,[1] Hiroto Inuzuka,[1] Yosuke Kageshima,[1,2] Katsuya Teshima,[1,2] Hiromasa Nishikiori[1,2]

We have previously reported that the local heat induced by visible and infrared light absorption by electronic defects and cocatalysts on TiO_2 particles accelerates the photocatalytic hydrogen production rete. In this study, we tried to increase the number of defects introduced into TiO_2 particles and to further promote the hydrogen production reaction by using $NaBH_4$, which has stronger reducing power, as a reducing agent during preparation of the reduced TiO_2. The effect of temperature near the photocatalytic particles in an aqueous suspension under light irradiation on the photocatalytic reaction rate was also evaluated.

Fig. 1 shows the dependence of hydrogen evolution activity of the $NaBH_4$-reduced TiO_2 on $NaBH_4$ mass ratio. During the photocatalysis, Pt nanoparticles were loaded on the reduced TiO_2 as a cocatalyst. Although the photocatalytic activities showed the volcano-type trend according to the amount of $NaBH_4$, all the reduced TiO_2 specimens unfortunately suffered from the deteriorated activity compared with the pristine TiO_2. Thus, improvement of reduction method might be necessary. In the presentation, the effect of temperature of the reaction solution under light irradiation on the hydrogen production rate will also be discussed.

Keywords : Photocatalysts; Black Titania; Oxide; Photothermal Effects; Reaction Temperature

これまでに、TiO_2 粉末上の電子欠陥や助触媒微粒子の可視～赤外域での光吸収に起因する光発熱が、光触媒的な水素生成反応を促進することを報告している [1)]。本研究では、還元 TiO_2 調製時に、還元力がより強い $NaBH_4$ を還元剤として使用することで、TiO_2 微粒子への欠陥導入量の増大及びそれによる水素生成反応の更なる促進を試みた。また、光照射下の水系懸濁液中における光触媒微粒子近傍の温度が、光触媒反応速度へ及ぼす影響についても評価した。

$NaBH_4$ 還元 TiO_2 の水素生成活性の、$NaBH_4$ 質量比依存性を Fig.1 に示す。活性評価時には助触媒として Pt 微粒子を還元 TiO_2 に担持した。$NaBH_4$ 添加量に対して水素生成活性は火山型を示す傾向にあるが、未処理の TiO_2 の場合と比べ活性は低下しており、還元方法の改善が必要と考えられる。発表では、光照射下の反応溶液の温度が水素生成速度に与える影響についても議論する。

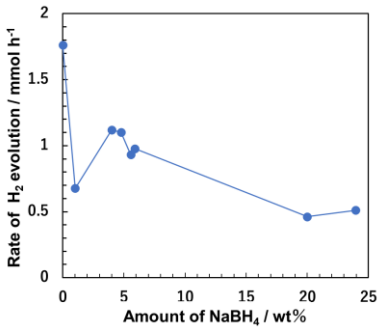

Fig. 1 The dependence of H_2 evolution rate on the amount of $NaBH_4$ used during the reduced TiO_2 preparation.

1) Y. Kageshima, *et al.*, *J. Phys. Chem. C* **2023**, *127*, 37, 18327–18339.