

Relationship between detailed condition of Pt nano co-catalyst on the surface of photocatalysts and its activity

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1. Introduction

Due to the consumption of large amount of fossil fuel, global warming and resource depletion become serious. To solve these problems, many researchers vigorously research to utilizing the natural energy. Among them, photocatalysts is one of the good candidates because they can convert solar energy directly into hydrogen chemical energy.

Until now, we reported that photocatalysts with specific morphology, called as stratified photocatalysts, showed extremely high catalytic activities, and extend their characteristic features to cadmium sulfide (CdS) which is a major visible-light active photocatalysts. However, because of low reduction ability of CdS, Pt should be deposited on CdS as a co-catalyst to enhance catalyst activities.

On the other hand, it is also true that cost become high by using the Pt as the co-catalysts. Moreover, resource amount of Pt is rare. Thus, the use of Pt should be decreased, and alternative co-catalysts should be developed.

Therefore, in this study, to fined the alternative co-catalysts for photocatalysts which can be stably act under H_2S condition, relationship between the condition of Pt co-catalysts, such as absorption condition of Pt precursors and synthesis mechanism of Pt nanoparticles, and the photocatalytic activity was tried to investigated.

2. Experimental

To control absorbed amount of Pt for photocatalysts, the surface potential of s-CdS and Pt complex condition in liquid solution as the function of pH was investigated by Electrospray Ionization-Time Of Flight-Mass Spectra (ESI-TOF-MS). By obeying these results, absorbed amount of Pt by ICP and photocatalytic activity with degradation of Na_2S solution as the function of the concentration of Pt was investigated.

3. Results and discussion

Fig.1 shows Pt complex condition in liquid solution as the function of pH measured by ESI-TOF-MS. From the result shows that $[PtCl_3]^-$ and/or $[Pt(OH)_2]$ is main species at pH3 ~ 7 and at pH10 ~ 13,

respectively. On the other hand, it is well known surface potential of CdS is negative at every pH¹⁾. So, it can be considered that $[PtCl_3]^-$ will successfully absorb onto the CdS surface by using the electric interaction between surface potential of CdS photocatalysts and charge of Pt complex at pH5 as the function of Pt concentration.

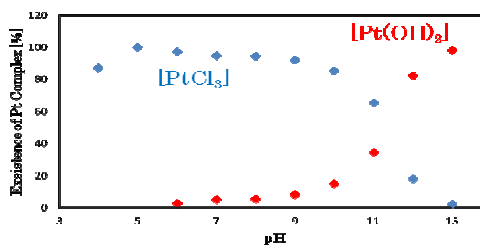


Fig.1 Result of existence of Pt complex as the function of pH

Fig.2 shows the amount of Pt adsorption on the surface of s-CdS (ICP results) and photocatalytic activity as the function of concentration of Pt at pH5, respectively. From these results, absorbed amount of Pt was almost 100% at all concentration, and it suggested that photocatalytic activity only depended on surface coverage ratio of photocatalysts by Pt. Photocatalytic activity shows the maximum value at 0.3mM.

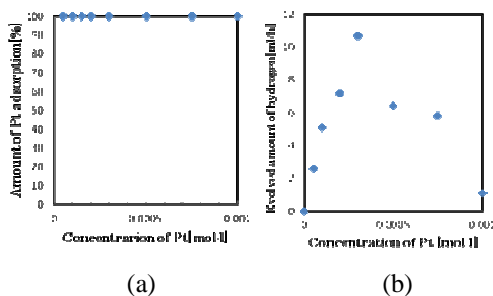


Fig.2 (a) The amount of Pt adsorption on s-CdS and (b) photocatalytic activity as the function of concentration of Pt at pH5

4. Conclusion

The relationship between the condition of Pt co-catalyst and photocatalytic activity become apparent. Other results will present in our presentation.

Acknowledgement

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Reference

1) Journal of Colloid and Interface Science, Vol.106, No.1, July 1985