1A3b

Preparation of TiO_2 nanoparticle by mechanochemical method and significant photocatalytic activity

○Tomoji WAKAMIYA[1], Ken-ichi SAITOW[1,2]

[1] Grad. Sc. Sci., Hiroshima Univ. [2] N-BARD, Hiroshima Univ

Photocatalysis is widely used as self-cleaning material such as an outer wall of building and a floor of operating room in the hospital. In particular, titania (TiO_2) is one of the most effective and widely used photocatalysis. It has been well known that TiO_2 is used as an excellent reagent for the photocatalytic hydrogen production from water, i.e. Honda-Fujishima effect. On the other hand, a ball milling is a mechanochemical method to generate fine particles. This method enables us to physically synthesis new materials, e.g. alloy, by mixing several reagents in a milling pot and to recently produce nanocrystalline materials.

In the present research, we produced TiO_2 nanoparticles by a planetary ball milling method. TiO_2 nanoparticles were prepared in a solvent by changing milling time or the rotational speed during milling. The photocatalytic activity of TiO_2 was evaluated by measuring the absorption spectra of methyle blue (MB) aqueous solution. The time evolution of photoredution reaction was investigated by tracking the change of absorption spectra. As a result, it was found that the photocatalytic activity of the generated TiO_2 is significantly enhanced by the milling process and its magnitude increases up to a factor of 130 before milling. In addition, the activity was is 60 times greater than that of commercial photocatlysis TiO_2, i.e. P25. According to the kinetics of photoreduction reaction and the analysis of X-ray diffraction measurement, the significant increase of activity was attributed to the amorphous structure of TiO_2 nanoparticle, given by higher-energy milling.

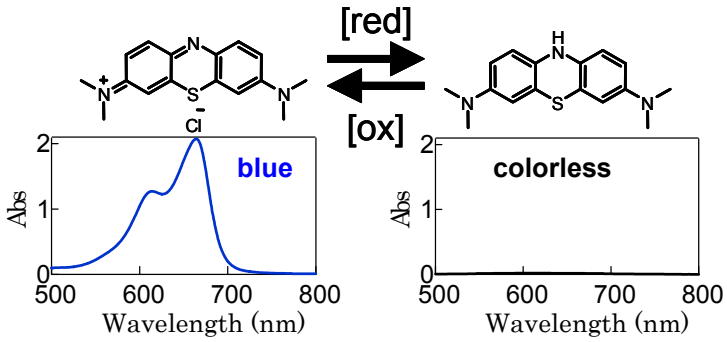

Fig.1 Absorption spectra of methylene blue (MB).The color change is caused by Redox reaction by the photoreduction reaction of MB

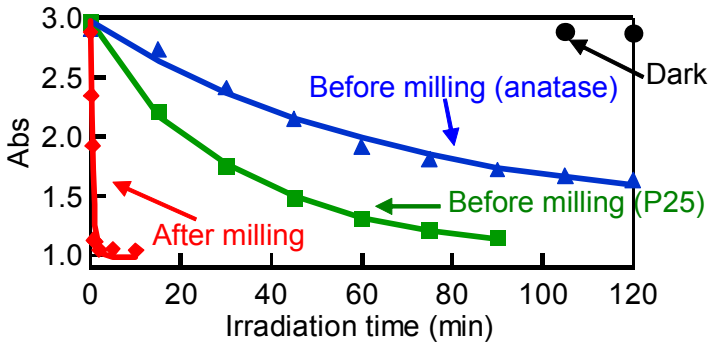

Fig.2 Absorbance changes of MB measured at 662 nm of MB as a function of UV irradiation time.