

Synthesis of Ag-deposited TiO₂ nanostructures and photo catalytic degradation of dye

Natarajan Prakash, Mani Navaneethan, Rajan Karthikeyan, Mukkannan Arivanandhan,

Tadanobu Koyama, Yasuhiro Hayakawa

Research Institute of Electronics, Shizuoka University, Hamamatsu-432-8011, Japan

nsprakashchem@gmail.com

[Introduction]

Water becomes a source of diseases because of the contaminants which are usually bio-recalcitrant [1]. Dyes are famous pollutants among various industries which have physical, chemical and biological stability. Titania (TiO₂) catalyzed photo degradation of dyes is one of the clean techniques to remove dyes without any harmful traces. Lack of visible light absorption and fast recombination rate reduce photo catalytic activity and limit TiO₂ from commercial applications [1, 2]. These drawbacks can be eliminated through modification of TiO₂. The work focuses on synthesis of modified TiO₂ and investigation of the photo catalytic degradation of organic pollutants.

[Experimental Procedure]

TiO₂ and silver deposited TiO₂ were synthesized by solvothermal method [3]. Titanium tetraisopropoxide (0.5 M) and silver nitrate (0.004 M) were added to 200 mL of butanol. The solution was stirred vigorously at room temperature for 30 min, and 57 mL of deionized water was added to the solution and stirred for 10 h. The white-colored solution was transferred to a 100 mL Teflon-lined stainless steel autoclave and solvothermal growth was carried out at 150 °C for 25 h. The resulting yellowish red coloured product was dried and annealed at 350 °C. The same procedure was repeated with different silver loading ranging from 0.004 M to 0.05 M. The properties were characterized by XRD, FESEM, EDAX, XPS and HRTEM analysis. 75 mg of catalyst was suspended in 50 mL of 10 ppm Rhodamine B solution and stirred for 1 h in the dark. Then the solution irradiated with a UV light of wavelength 365 nm, and absorbance of the solution was recorded at constant time intervals.

[Result and Discussion]

The Ag_{5/2} and Ag_{3/2} binding energy levels were 368.6 and 374.8 eV, respectively, suggesting that Ag existed in metallic state (Fig. 1(a)). XRD peaks at 2θ values 25.2° and 44.4° attributed to the (101) peak of anatase TiO₂ and (200) peak of face centred cubic metallic silver, respectively (Fig.1 (b)). TEM images of Ag-TiO₂ confirmed that the spherical nanoparticles ranging from 4-10 nm were interconnected with each other (Fig. 1(c)). The gradual decrease of Rhodamine B absorbance at 554 nm in the UV-Vis spectra indicated the degradation of dye using Ag-TiO₂ (A0.8) (Fig. 1 (d)).

[Reference]

- [1] Liu et.al, Catalysis Today **93-94** (2004), 877.
- [2] Michael K. Seery et.al, J. Photochemistry and Photobiology A: Chemistry **189** [2- 3] (2007) 258.
- [3] M. Navaneethan, Y. Hayakawa et.al, J. Power Sources **242** (2013) 803.

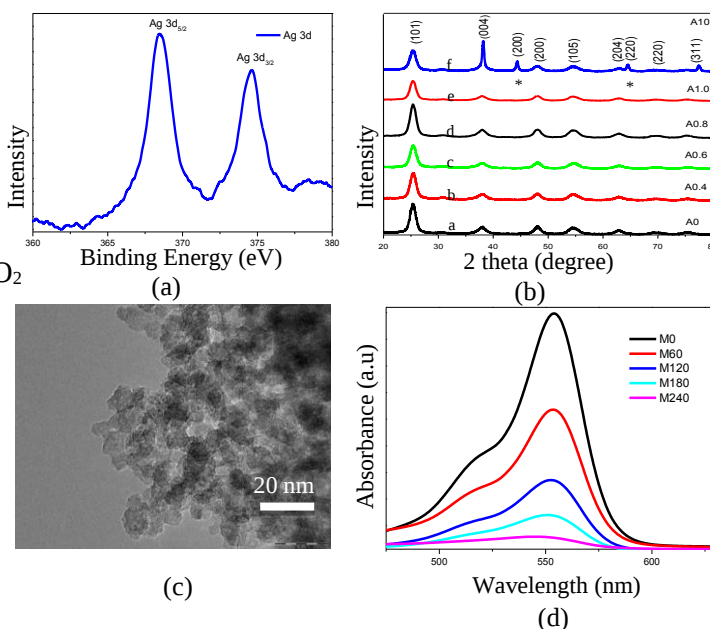


Fig.1 (a) XPS spectrum of Ag 3d b) XRD of Ag-TiO₂ c) TEM image of Ag-TiO₂ (A0.8) d) Rhodamine B absorbance at different times