

**ENHANCEMENT OF PHOTOCATALYTIC
ACTIVITY OF NANO-SIZED TITANIUM DIOXIDE
THIN FILMS BY TRIFLUOROACETIC ACID
MODIFICATION**

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Titanium dioxide is the most widely used semiconductor for the degradation of pollutants by heterogeneous photocatalysis. TiO₂ also exhibits superhydrophilic properties upon UV irradiation. The latest commercial application of this material is the self-cleaning and antifogging glass prepared by coating a thin film of TiO₂ on glass. The objective of the present work was to develop a simple method to enhance the photocatalytic activity of these thin films. TiO₂ films were prepared using sol-gel method on soda-lime glass pre-coated with a layer of SiO₂, then treated by dipping in aqueous trifluoroacetic acid (TFA) aqueous solution. The photocatalytic activity of the films was evaluated by photocatalytic decomposition of acetone in air. The adsorption of TFA on TiO₂ thin film was investigated by FTIR spectroscopy, X-ray photoelectron spectroscopy (XPS), UV-VIS spectroscopy, photoluminescence (PL), BET surface areas and differential thermal analysis-thermogravimetry (DTA-TG). The results show that TFA is chemisorbed on the surface of TiO₂ thin films. The photocatalytic activity of TFA modified TiO₂ thin film is higher than that of pure TiO₂ (Fig. 1). This is ascribed to the fact that the trifluoroacetate complex (Scheme 1) could attract and transfer photo-generated electrons in the conduction band of TiO₂ and reduce the electron and hole recombination rate, leading to improvement of photocatalytic activity. The PL intensity of the modified TiO₂ is weaker than that of untreated TiO₂, indicating a lower recombination rate of electrons/holes under UV irradiation.

References:

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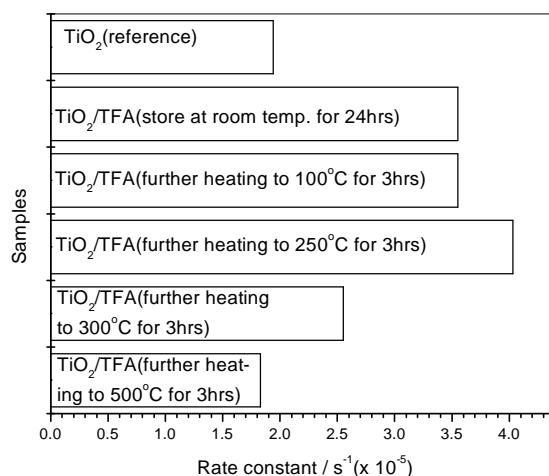
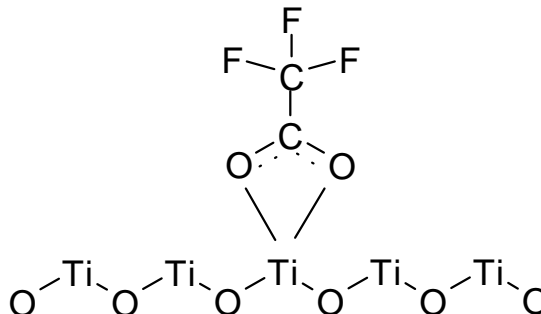


Fig. 1. Degradation rate of acetone on TiO₂ thin films before and after TFA treatment.



Scheme 1. Bidentate structure of trifluoroacetate on TiO₂ surface.