

EFFECT OF Mo + Cr CODOPING LEVELS ON THE PHOTOCATALYTIC PERFORMANCE OF SOL-GEL DERIVED AND ION IMPLANTED TiO₂ THIN FILMS

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Titania (TiO₂) is one of the most widely used photocatalysts with applications in water splitting, air purification and dye sensitised solar cells. However, its wide band gap (3.0–3.2 eV) makes it inefficient under visible light. There is potential to lower the band gap and improve photocatalytic efficiency through codoping and ion implantation by transition metal ions.

In present work, uniformly codoped TiO₂ thin films of varying Mo and Cr concentrations (0–1.00 mol% for each dopant) were fabricated using spin coating and deposited on fused silica substrates. All films were annealed at 450°C for 2 h to recrystallise the TiO₂. The undoped samples were subjected to ion implantation by Mo, Cr, and both Mo + Cr at 1×10^{14} atoms/cm² and annealed again at 450°C for 2 h. The films were characterised to determine their mineralogical and surface properties using X-ray diffraction, Raman spectroscopy, atomic force microscopy, secondary ion mass spectroscopy, and X-ray photoelectron spectroscopy. Photocatalytic activity was examined by testing the absorbance of methylene blue solution (UV-vis spectroscopy) after irradiation by UV light for different time periods.

In the uniformly codoped films, the crystallinity of the films increased when the codopant level was below the solubility limit of the dopants. However, above the solubility limit, dopant precipitation at grain boundaries resulted in grain pinning and amorphisation, decreasing the crystallinity of the films. Overall, it was found that photocatalytic performance decreased with increase in codopant content owing to lattice strain. Ion implantation of undoped thin films with Mo and Mo + Cr improved the photocatalytic performance of the film. It is thought that Cr increased the formation of oxygen vacancies which lowered the band gap and improved photocatalytic efficiency.

Speakers Gender

Female

Travel Funding

No

Level of Expertise

Student

Do you wish to take part in the poster slam

Yes

Primary author(s) : Ms CHEN, Amanda (UNSW Sydney)

Co-author(s) : Dr CHEN, Wen-Fan (National Sun Yat-sun University, Taiwan); KOSHY, Pramod (UNSW Sydney); Dr ATANACIO, Armand (Centre for Accelerator Science ANSTO); Dr MANOHAR, Madhura (Centre for Accelerator Science ANSTO)

Presenter(s) : Ms CHEN, Amanda (UNSW Sydney)

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