Contribution ID : **91** Type : **Poster**

Optimization of Ion Implantation Parameters for Photocatalytic Coatings on Conducting and Insulating Substrates

Monday, 2 December 2019 18:48 (1)

Titanium dioxide (TiO2) is the most commonly used photocatalyst which is activated by UV irradiation to generate electron-hole pairs that can contribute to the destruction of inorganic compounds to water and CO2. The photoeffciency of TiO2 is limited in visible light due to its wide band gap and high photo-induced charge recombination rates. A potential solution to this issue is to dope TiO2 with transition metals via low energy ion implantation (LEII) technique available at the ANSTO Centre for Accelerator Science. Previous LEII work has shown that the as-implanted dose can be significantly different from the intended nominal value when implanting insulating substrates. This can impact on the accuracy of the dosage, particularly for designing advanced materials for photocatalytic applications. Thus there is a need to investigate the effects of implanting different metals in a photocatalytic coating deposited on insulating and conducting substrates in order to determine the effect of implantation parameters on the accuracy of the implantation dosage.

This collaborative Honours thesis project between UNSW and ANSTO investigates the correlation of implantation accuracy with coating type, conductivity of substrates, and dopant type to optimise the ion implantation process. A semiconducting photocatalytic TiO2 thin film was deposited by spin coating of sol-gel precursor (titanium isopropoxide and isopropanol) on silicon and fluorine doped tin oxide (FTO) glass substrates followed by annealing at 450℃ for 2 h. The TiO2 coated substrates were implanted with Mo and Cu ions at nominal doses of 1x1014 to 1x1016 atom/cm2. The implanted samples were characterized using both particle induced X-ray emission (PIXE) and Rutherford backscattering spectroscopy (RBS) at ANSTO to determine the actual concentration of implanted dopant. The microstructural and mineralogical characteristics of the implanted samples were characterized at UNSW using scanning electron microscopy (SEM) and X-ray diffraction (GAXRD), respectively. Atomic force microscopy (AMF), X-ray photoelectron spectroscopy (XPS) and laser Raman spectroscopy were employed to determine the surface roughness, grain size, surface composition and confirmation of mineralogy of TiO2 coated samples before and after implantation. Photocatalytic testing using dye degradation (methylene blue) under UV and solar irradiation were conducted to determine the effect of implantation on photocatalytic performance. The outcomes of this research will provide critical data which will allow for increased accuracy of ion implantation on substrates of varying conductivity and allow for optimization of implantation dosage for enhanced performance for different applications.

Speakers Gender

Female

Travel Funding

No

Level of Expertise

Student

Do yo wish to take part in the poster slam

Yes

Primary author(s) : Ms KE, Jialuo

Co-author(s) : Dr ATANACIO, Armand (Centre for Accelerator Science ANSTO); Prof. SORRELL, Charles Christopher (School of Materials Science and Engineering UNSW Sydney); Dr MANOHAR, Madhura (Centre for Accelerator Science ANSTO); KOSHY, Pramod (UNSW Sydney); Dr CHEN, Wen-Fan (National Sun Yat-sun University, Taiwan)

Presenter(s) : Ms KE, Jialuo

Session Classification : Welcome Function