SMNZI Final Year Student Award Prizes 2016

University of Auckland, Department of Chemical and Materials Engineering

Co-winners First Prize (Student Presentations):

Rakesh Arul

Presentation: Ultrafast Laser Patterning of Titanium Dioxide Nanotubes

The project coupled materials science and photonics with the use of computational modelling to guide the design of better photocatalysts. Ultrashort laser pulses were used to structure the surface of titanium and titanium dioxide. These intense laser pulses produce self-organized nanometre scale ripples on the surface of titanium. Subsequently, titanium dioxide nanotubes were grown on the ripples, and an enhanced visible light absorption was demonstrated. This enhanced absorption is expected to correlate with better photocatalytic efficiency for the degradation of environmental pollutants in wastewater. Furthermore, the mechanism of nanotube growth and the ultrafast laser interaction process with titanium dioxide was elucidated, in order to provide fundamental scientific understanding.

Jake Sun

Presentation: Anodic Tungsten Oxides: Synthesis, Characterisation and Heterogeneous Photocatalysis

Semiconductor based photocatalysis is gaining traction in recent years in environmental remediation applications. In this work, the electrochemical syntheses of tungsten oxide nanostructures are investigated, with an objective to combine the large specific areas of the nanostructures and visible light absorption capabilities of the tungsten oxides for high performance wastewater treatment processes.

Using aprotic and anhydrous electrolytes, stacked nano-sheets and macroporous Nano-particulate network morphologies were realised for the first time on tungstenoxides. Concentration of the defect species, band gap, optical properties and lattice dynamics of the defective oxides were readily tuneable by manipulating anodisation voltage and applying heat treatment. Photocatalytic degradation experiments of Rhodamine B showed that, although light absorption was enhanced, the degradation efficiency of the defective oxides were only 20% of that of the pristine oxide due to increased carrier scattering by lattice defects and thus carrier recombination.

University of Waikato, School of Engineering

Excellence in Materials Engineering:

1st place: Patrick Leslie

2nd place: Daniel Hishon