Titania nanomaterials as photocatalysts

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Presentation Preference: Oral

Career Level: Career Scientist (>5 yrs post PhD)

Aligned with Science Focus: materials, photocatalysis

Abstract:

TiO_2-based photocatalyst materials are widely researched for environmental remediation applications as titania is non-toxic, readily available and inexpensive. However, TiO_2 suffers from a relatively low photocatalytic activity caused by (i) the recombination of photon induced electron and hole pairs (~90%); (ii) a wide band gap that requires high energy UV radiation (only 5% of sun light) to induce the reaction; and (iii) the recovery issues of photocatalyst nanoparticles after the photocatalytic reaction. Hence the ability to either decrease the band-gap of titania to allow photoactivity on irradiation with visible light or decrease the electron/hole recombination rate is attracting more attention. It has also been reported that the preparation method plays an important role in determining the photocatalytic activity of the final product.

In this presentation, TiO_2-based materials with various morphologies and their photocatalytic activity have been investigated to address the above issues for the practical applications. Diverse synthesis techniques, such as solvothermal treatment, sol-gel chemistry and electrospinning techniques have been employed to prepare these materials. The properties of the resultant materials, including crystal phase and crystal size, surface hydroxyl group, surface areas, porosity, optical property and morphology were examined. The photocatalytic efficiency of the materials was assessed by studying the photodecomposition of methylene blue under both UV and Visible light. The results of in-situ determination of the crystal phase of TiO_2 material by using the Australian Synchrotron Powder Diffraction beam line and how this information guides optimisation of the material synthesis will also be discussed. The photocatalytic activities of materials produced under optimized conditions were studied. A correlation between material properties and photocatalytic activity will be discussed.

Biographical Statement of speaker:

Dr Xingdong Wang conducted her PhD at The University of Melbourne, and currently works as a research scientist in CSIRO Manufacturing. Xingdong's research interests include templating techniques, sol–gel chemistry, solvo-hydrothermal synthesis, synthesis and engineering of nanoparticles and porous noble metal modified TiO_2, sensors, high-throughput, and photocatalytic applications for environmental remediation and potentially green energy generation.

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