Laboratory for Precision and Nano Processing Technologies

UNSW AUSTRALIA

Never Stand Still | Engineering | Mechanical and Manufacturing Engineering

Scientia Professor Liangchi Zhang

LPNPT

The UNSW Laboratory for Precision and Nano Processing Technologies is led by Scientia Professor Liangchi Zhang. This is a world-leading laboratory, equipped with advanced research facilities for testing, characterisation and manufacturing. The reseach covers a broad range of frontier areas - both the fundamentals of technologies, and their direct applications to industry. The research group have published over 550 academic papers and 20 books, and have about 10 patents. The citations of their papers are ranked among the top in their research areas. The group have established close collaborations with industry partners including Silanna Australia and Baosteel China. Their research has led to the substantial improvements in production efficiency, energy and resource savings and green manufacturing processes for their industry partners, which has enabled them to achieve significant economic benefits annually, in tens of million dollars.

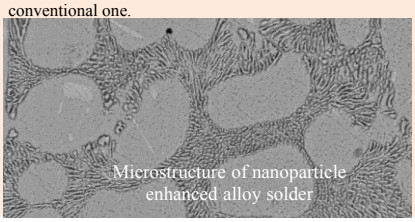
World-leading equipment for experiments, manufacturing and testing

Examples of Ongoing Research

- **Deformation mechanisms of advanced materials**
- **Defect-free manufacture of crystalline and composite materials**
- **Manufacure of precision optical lenses and devices**
- **Development of biomaterials, prostheses and electronic packaging materials**
- **Novel techniques for advanced metal forming processes and friction control**
- **Micro/nano and interface thermal conductivity measurement**

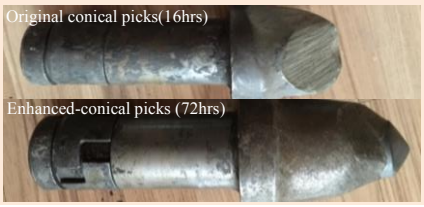
Nanoparticle-enhanced alloy solder

We have developed novel nanoparticle-enhanced alloy solders with improved microstructure and superior mechanical properties. The performance of this novel alloy solder improved 16%, compared to that of the conventional one.



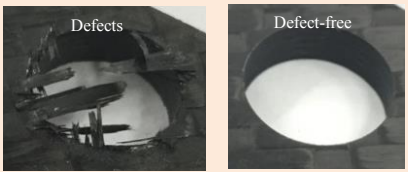
High-performance mining picks

We have developed low cost technique that can increase the wear resistance of a mining pick for more than 4 times (confirmed via in-situ underground coal mining application).



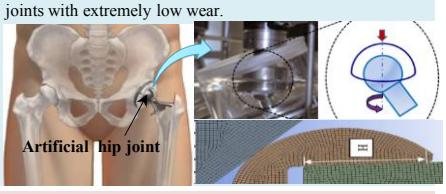
A novel drill to produce defect-free holes in fibre enhanced composites.

A novel drill that can avoid damages (e.g., fibre pull-out, fibre fragmentation, fibre-matrix debonding and delamination) in fibre-reinforced composites. This has led to the successful production of damage-free and near-damage-free holes on fibre-reinforced composites



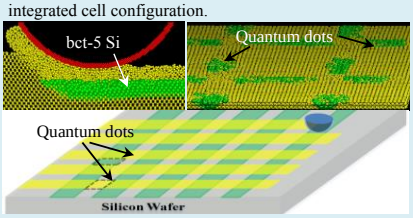
Advanced material and its manufacturing for artificial hip joints

The advanced high-performance material has been obtained for artificial joints, which is the result through interdisciplinary research involving materials science, mechanics, biocompatibility, manufacturing process and tribology. This has made it possible to manufacture hip joints with extremely low wear.



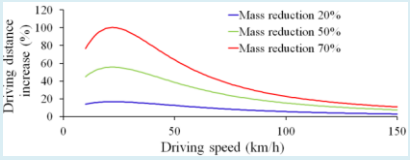
Quantum dots fabrication

This research aims to develop a brand new high technology process to produce low cost, non-toxic nanomaterials for advanced nanoscale devices, e.g., a new generation of photovoltaic cells with an ideally integrated cell configuration.



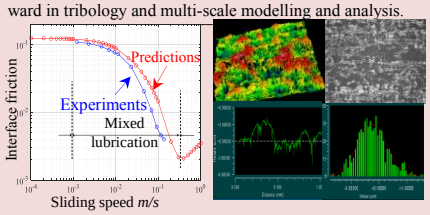
Lightweight body design for energy saving electrical vehicles

We are developing optimal designs for electric vehicles based on lightweight materials, optimised structures and advanced manufacturing techniques. Such designs would reduce the total weight of an electric vehicle by 30% and improve its performance by 38%.



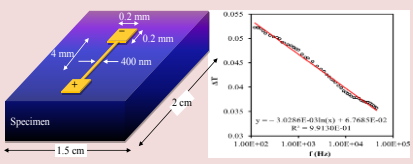
Friction prediction and control

We have successfully developed a multiscale analysis technique for the prediction and control of interface friction when randomly rough surfaces are in contact sliding under lubrication. This is an important step forward in tribology and multi-scale modelling and analysis.



Interface and thin film thermal conductivity measurement

We have established a method capable of 'thin-film thermal conductivity' and 'interface thermal resistance' characterisation. A software package has been in place for industrial applications.



In-situ interface temperature measurement

We have successfully developed a novel technique to make in-situ measurements of interface temperature between two surfaces in contact sliding. This has enabled the characterisation of interface temperature for systems involving friction and wear under dry contact sliding conditions.