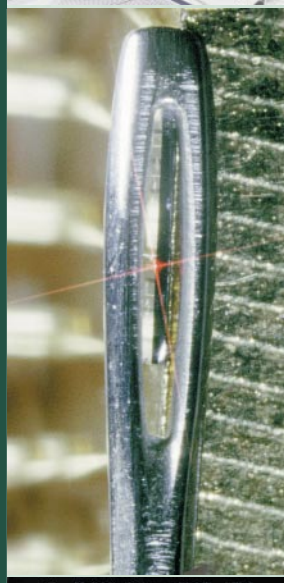
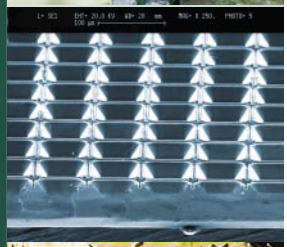
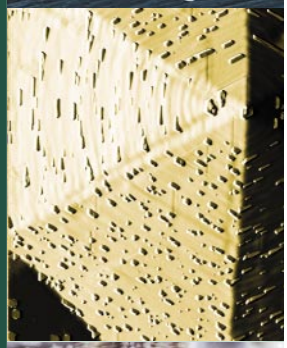
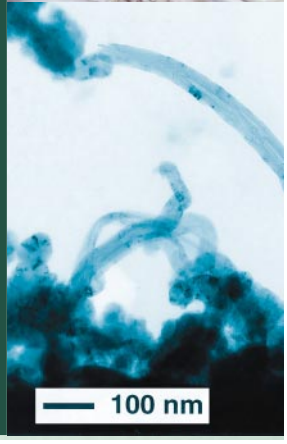
Nanoscale Science and Technology

at the Australian National University









VISION:

Over the next decade, the frontiers of research in science, engineering and technology will be driven to a dominant extent by breakthroughs and developments in nano- and bio-materials. This forefront research provides the capacity to build up and tailor material properties or structures that have new and exciting properties. The field is multi-disciplinary with multi-sector applications covering chemical, electronic, optoelectronic, medical and pharmaceutical industries. ANU is a world leader in this emerging field, with an enormous breadth of programs covering patterning of ultra-small structures that are engineered for novel applications (the so-called top down approach), through the capability to build up materials with unique properties from the molecular level (the bottom up approach). Such controlled processing on a nanoscale can also facilitate the growth of nanoparticles and dendrites or the deposition of ultra-thin films with very attractive, physical, chemical or biological properties.

There are more than 100 scientists and engineers at ANU that are actively involved in research in nano-scale science and technology covering almost all the science and engineering disciplines. The ANU is investing close to $7 M per annum to support this research, with an estimated $60 million worth of unique and specialized facilities. Researchers at the ANU interact extensively with other Australian universities, the CSIRO and other institutions in Australia and overseas to maximize the outcomes of their nano- and bio-materials research.

Some examples of the research programs and highlights are given below:

Semiconductor Nanotechnology

- Innovative growth and processing of quantum dots and quantum wires with novel physical, electrical and optical properties
- Using nanostructures for entirely new and improved solar cells, lasers, detectors and photonic integrated circuits for use in the communications, medical, energy and manufacturing industries
- Developing bright metastable atom beams to create nanoscale patterns that can be used to make nanomachines and miniature robots

Biological Nanoscience and Bio Materials

- Bio-mineralisation research to enable deposition of ceramic nanomaterials by living organisms
- Biochemical reactions of amino acids, peptides, proteins and the evolution of enzymes
- Chemical synthesis of organic compounds and their incorporation in nanostructures

Materials Science on the Nanoscale

- Ultrafast laser ablation to create nanomaterials with extraordinary properties such as carbon foam
- Mechanochemical synthesis of ultra strong, light weight nanoparticles and nanotubes
- Using non-conventional methods to produce semiconductor nanocrystals which emit bright light
- Synthesis of ordered nanostructures using electro-chemical processes
- Study of the thermodynamic behaviour of small systems including nanomachines
- Using molecular hosts as microreactors for chemical processing
- Using advanced electron microscopy, diffuse x-ray scattering, scanning probe microscopy and synchrotron based techniques to study structure at the nanoscale.

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