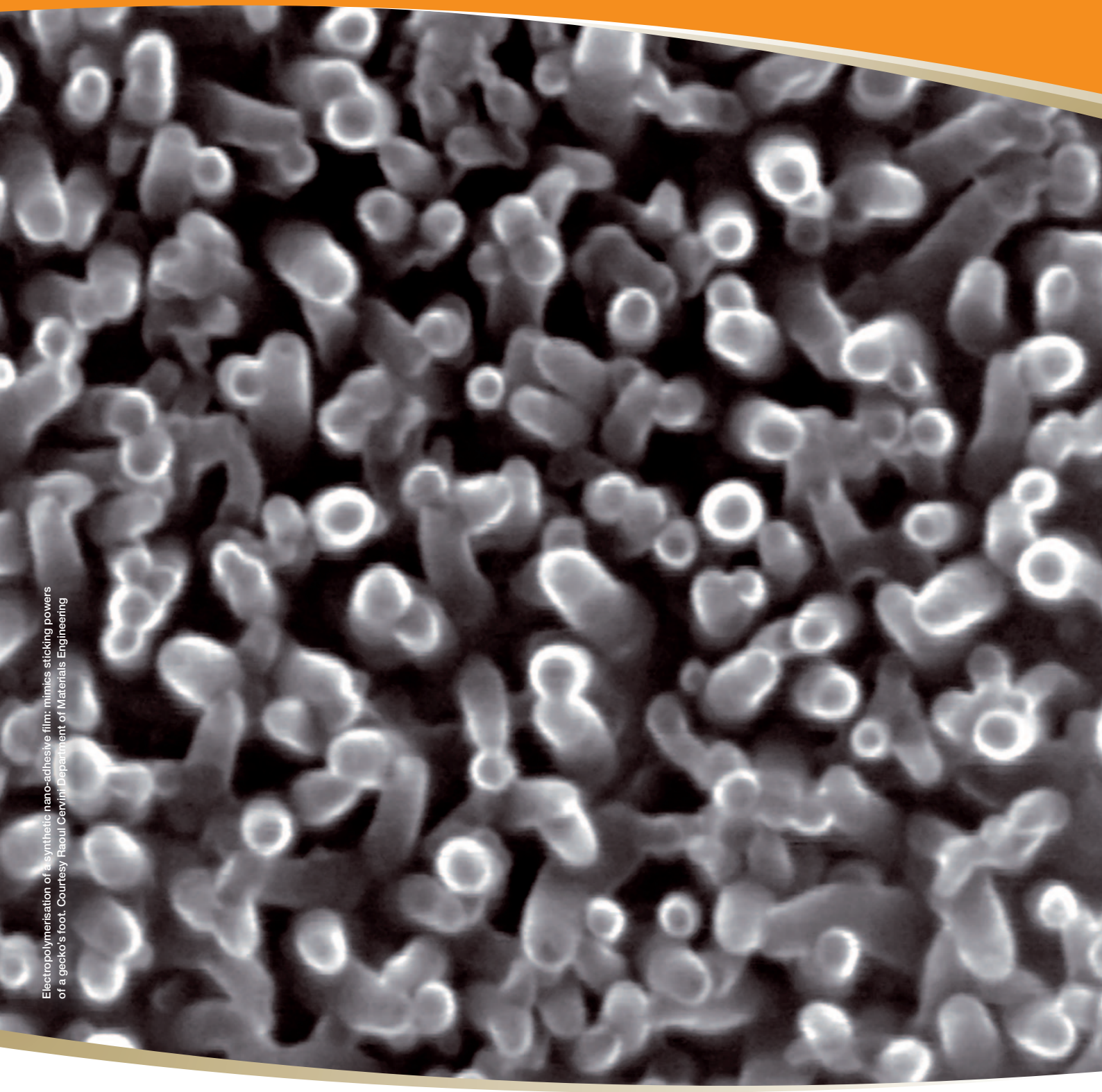
MONASH University
Engineering

GROUP OF EIGHT

Nanotechnology

Department of Materials Engineering



Electropolymerisation of a synthetic nano-adhesive film: mimics sticking powers of a gecko's foot. Courtesy Raoul Cervini Department of Materials Engineering

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Interested in nanotechnology and nanomaterials?

Nanotechnology is a crucial part of the present and future of science and engineering. There are industries using nanotechnology today, and the number is increasing rapidly. To a large extent, nanotechnology involves manipulating materials properties(1). That is, much of nanotechnology relies on the ability to be able to probe, understand and control materials on the nanometer (atomic) scale (10^{-9}m). That's where materials science and engineering comes in. The Department of Materials Engineering at Monash University is a leader in this exciting field and offers opportunities for both undergraduates and postgraduates.

What is nanotechnology?

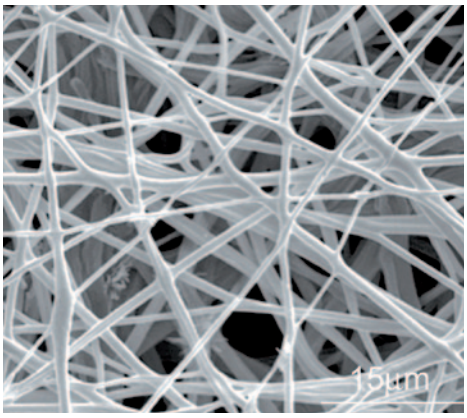
Nanotechnology involves working with materials at the nanometer level, that is tens of atoms, to create structures, devices and systems that have useful and unique new properties.

Nanotechnology is smaller than micron-scale (microtechnology, where objects can be fabricated with fairly standard equipment) and bigger than angstrom scale (essentially chemistry).

Many material properties change dramatically when they are very small (when their surface area gets very large compared to their volume). This can change optical, electrical and magnetic properties, to name a few. "(For instance, opaque substances become transparent (copper); inert materials become catalysts (platinum); stable materials turn combustible (aluminum); solids turn into liquids at room temperature (gold); insulators become conductors (silicon)."(2)

Nanomaterials can be produced by reducing the size of materials to a nano-scale (top-down approach) or building up structures from the atomic level (bottom-up approach).

Nanotechnology becomes possible because materials can now be manipulated on the nano-scale (such as by electron beam lithography) and can now also be viewed and measured on this scale (atomic force microscopy, electron microscopy).



Nanofibrous scaffolds for tissue engineering.

Nanotechnology has already had significant impacts, with **materials engineering and the Department of materials engineering at Monash** actively involved in some of the following:

- advanced composites for the aerospace industry
- electromagnetic device applications
- new, cheaper solar cells
- improved drug delivery devices
- tissue engineering, producing stem cell scaffolds
- light metal alloys
- advanced high-strength steels
- corrosion protection using nanomaterials
- atom-by-atom design of new materials
- modification of metals' microstructure and properties at atomic level for energy storage
- electron microscopy
- biomimicry

In what industries will nanotechnology and nanomaterials be important?

Nanoscale materials and nanotechnology is likely to be important in the following industries: electronic, optoelectronic, biomedical, pharmaceutical, cosmetic, transport, membrane, catalysis and energy sectors. Within these industries, materials scientists and engineers will fulfill a range of roles, from researcher to process engineer to quality control to business development to marketing to patent law.

What are your options?

Bachelor of Engineering and Materials Science

The Department of Materials Engineering offers subjects which underpin the basics of nanomaterials, as well as offering a stream of nanotechnology-focused units across all years.

First year
ENG1050/MSC1010 Engineering materials
Second year
MTE2541/MSC2011 Nanostructure of Materials
MTE2542/MSC2122 Microstructural development
MTE2544/MSC2111 Introduction to functional materials
MTE2548 Biomaterials I
Third year
MTE3542/MSC3121 Microstructural Design
MTE3547/MSC3142 Materials Characterisation
MTE3545/MSC3132 Functional materials and devices
Fourth year
MTE4525 & MTE4526 Materials engineering project. Undertaking hands-on research in nanomaterials and bionanotechnology
MTE4597 Nanomaterials
MTE4539 Biomaterials II

Bachelor of Biotechnology with Honours

This new degree, which was developed in consultation with industry, gives students the option to take a nanobiotechnology stream which will focus on the interface between engineering and biotechnology. The course comprises an exciting combination of science and engineering subjects with a final year research project and a commercial product development project.

Enquiries

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(1) "MICRO SERVES AS FLAWED MODEL FOR NANOTECH COMPANIES", Kees Eijkel, Small Times, July 29, 2005
(2) http://en.wikipedia.org/wiki/Nanotechnology