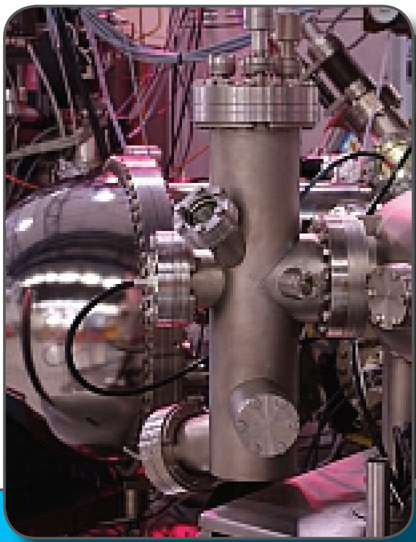

# Nanotechnology at work

**Nanotechnology is an emerging scientific field creating materials, devices, and systems at the molecular level. By being able to work at this ultra-small scale, nanotechnology is being used to deliver innovations in industries including clean energy, environment, health and personal care, electronics, transport, construction, telecommunications, manufacturing and mining.**

Australian Synchrotron
Turning bright ideas into brilliant outcomes

ABOUT AUSTRALIAN SYNCHROTRON

The Australian Synchrotron is a source of highly intense light ranging from infrared to hard x-rays used for a wide variety of research purposes.


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**Images: Top left, Researchers are using soft x-rays to investigate nanodiamond films with valuable industrial applications. Photo: Australian Synchrotron; top right, Bruce Cowie on the Australian Synchrotron soft x-ray beamline. Photo: Sandra Morrow**

## Invisible diamonds

Thanks to Marilyn Monroe, it's common knowledge that diamonds are a girl's best friend. Less glamorous than Marilyn's diamonds, but more valuable on an industrial scale are diamonds so small that thousands could fit in a space no wider than a human hair.

Researchers are developing films containing millions of tiny diamond crystals to harness their exceptional hardness and heat conductivity for new industrial purposes. More versatile than large single crystals, these films can be deposited on silicon, steel or other surfaces.

Synchrotron X-rays are providing the analytical tools and production methods to realise the potential of new diamond applications such as protective films for knife edges, electron emission devices, heat sinks for solid state lasers and thermo-electric energy converters to generate power from waste heat. Nanodiamonds can also generate photons for quantum communication and cryptographic devices being developed for secure telecommunications.

In simple terms, a synchrotron is a very large, circular, megavoltage machine about the size of a football field. Synchrotrons use electricity to produce intense beams of light a million times brighter than the sun. The light is produced when high-energy electrons are forced to travel in a circular orbit inside the synchrotron tunnels by 'synchronised' application of strong magnetic fields.

The electron beams travel at just under the speed of light – about 299,792 kilometres per second. The intense light they produce is filtered and adjusted to travel into experimental workstations, where the light reveals the innermost, sub-microscopic secrets of materials under investigation, from human tissue to plants, metals and even diamonds.

Synchrotron science enables users to study the structure and properties of materials at unprecedented levels of detail. Synchrotron technologies surpass conventional methods and help drive innovation across many areas of pure and applied research and industrial development.