

# Nano in My Life

The word nano means  $10^{-9}$  so a nanometer is one billionth of a meter. One definition of nanoscience is that it concerns itself with the study of objects which are anywhere from hundreds to tens of nanometers in size.



The nano iPod is getting smaller as the information we have from nanoscience progresses. The size of the iPod is proof of this



## Computers

Smaller, lighter computers and an end to worries about electrical failures sending hours of on-screen work into an inaccessible limbo mark the potential result of Argonne research on tiny ferroelectric crystals.

"Tiny" means billionths of a meter, or about 1/500th the width of a human hair. These nanomaterials behave differently than their larger bulk counterparts, exhibit new electronic properties and can be used to create materials that are stronger, tougher and more resistant to friction and wear than bulk materials.

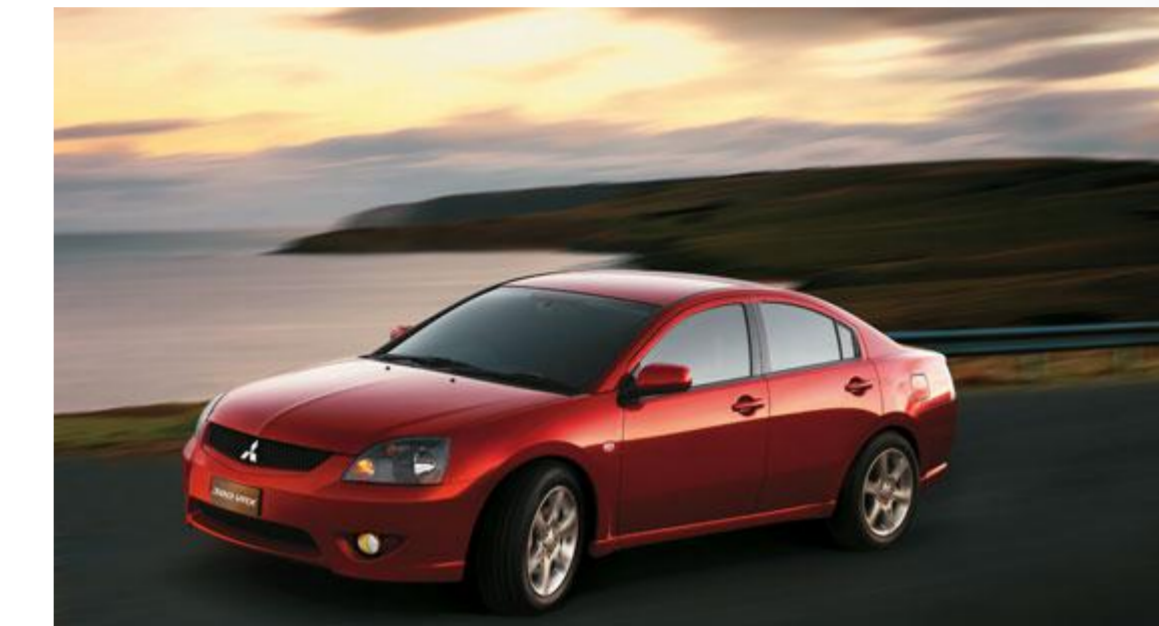
Improved nano-engineered ferroelectric crystals could realize a 50-year-old dream of creating nonvolatile random access memory (NVRAM). The first fruits of it can be seen in Sony's PlayStation 2 and in smart cards now in use in Brazil, China and Japan. A simple wave of a smart card identifies personnel or pays for gas or public transportation.

### Computing applications

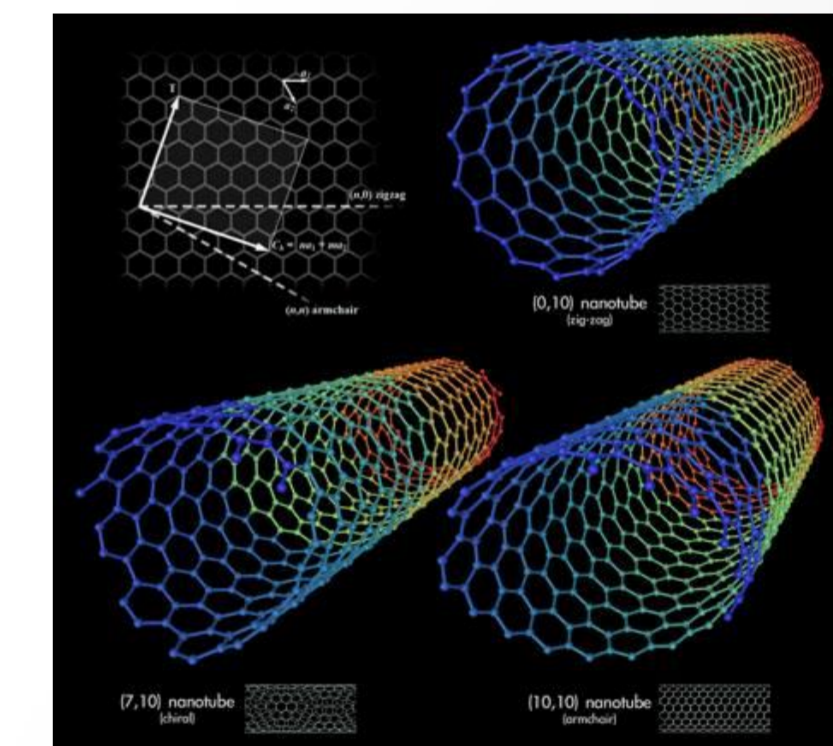
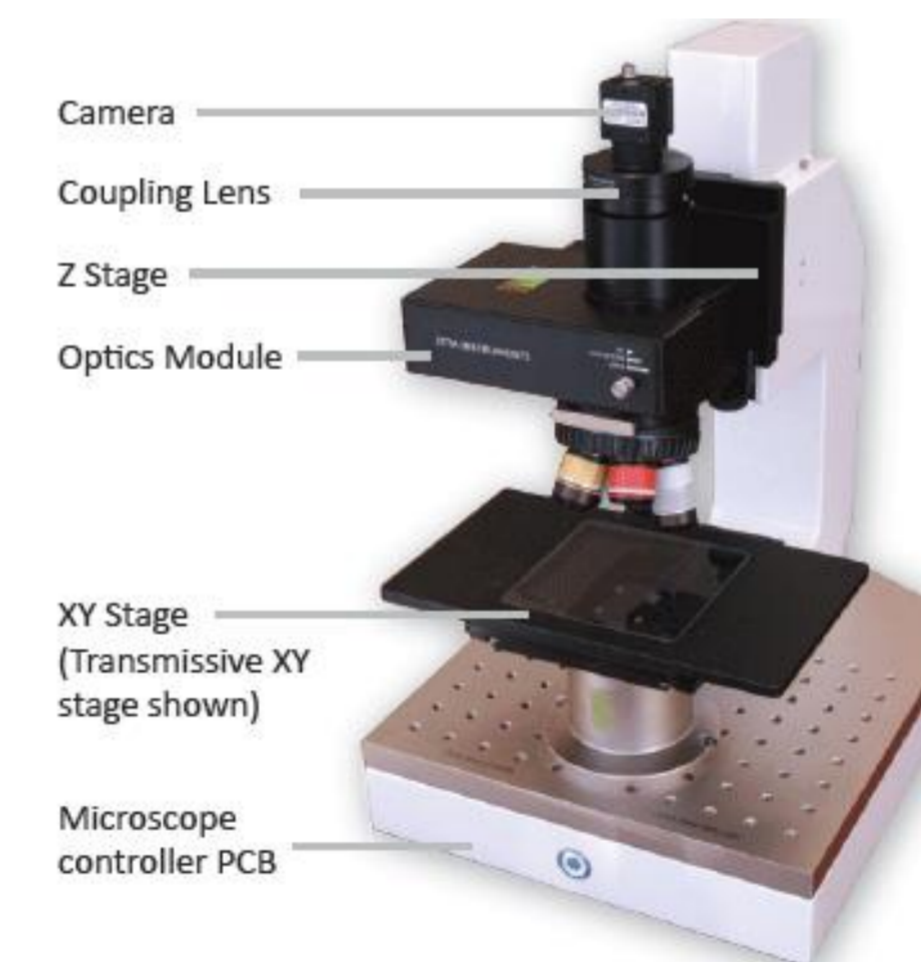
RAM – random access memory – is used when someone enters information or gives a command to the computer. It can be written to as well as read but - with standard commercial technology - holds its content only while powered by electricity. Because the crystals do not revert spontaneously, RAM made with them would not be erased should there be a power failure. Laptop computers would no longer need back-up batteries, permitting them to be made still smaller and lighter. There would be a similar impact on cell phones. Achieving such permanence is a long-standing dream of the computer industry.

## Nanotechnology is new!

It often comes as a surprise to learn that the Romans and Chinese were using nanoparticles thousands of years ago. Similarly, every time you light a match, fullerenes are produced. Degussa have been producing carbon black, the substance that makes car tyres black and improves the wear resistance of the rubber, since the 1920s. Of course they were not aware that they were using nanotechnology, and as they had no control over particle size, or even any knowledge of the nanoscale they were not using nanotechnology as currently defined. What is new about nanotechnology is our ability to not only see, and manipulate matter on the nanoscale, but our understanding of atomic scale interactions



Microscopes are what we currently use to see smaller things. Imagine looking at everything at this level, that's what nanoscience is looking at.



The carbon nanotube is used in electronics it is approximately 1/50,000<sup>th</sup> of the human hair but stronger than the wires currently used in electronic appliances.



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