

# Nanotechnology — a reality check

Nanotechnology is engineering at the atomic level involving dimensions in nanometres — one nanometre being one-billionth of a metre. At that level, boundless possibilities exist for machines, computers and products. But is it all hype or does nanotechnology hold great promise for the world of technology?

**Pek Tieng Gee** asks scientist Meyya Meyyappan, director of the Center for Nanotechnology at the NASA Ames Research Center in California.

**At what stage of development is nanotechnology? Is it still closer to the realm of science fiction than reality?**

Nanotechnology is in its early stages. It will take 10 to 15 years to see a mass-market impact. Then again, that is typical of any technology. Let us look at biotechnology. It has been around for 20 years but only four to five companies have made real profits on a regular basis. Hundreds of other bio-companies are spending venture capitalists' money and not making any profits. The point is — it takes time.

To answer if nano is science fiction or reality, that depends on whom you are listening to. There are people who make outrageous claims resembling science fiction, like self-replicating nano robots; then, there are a lot of serious people working on more utilitarian nanotechnologies to impact various sectors.

**Which area of science and technology is likely to be the first to benefit from nanotechnology? When will that be?**

As an enabling technology, nano will impact every sector: electronics, computing, memory, communications, materials, manufacturing, health, medicine, transportation, energy, environment and so on. The maturity time is going to be different for different sectors. For example, nanoparticles can have an impact

on the cosmetics, catalysts and inkjet printing business now and in the near term. On the other extreme, replacing silicon-based computer chips will take 15 years or so. Production of flat-panel display screens will benefit early.

**How long will it take for nanotechnology to become viable in commercial applications? Which commercial firms are doing research on nanotechnology?**

There are some viable commercial applications even today such as the examples given on nanoparticles. Companies are using nanoparticles with ultraviolet protection capability in suntan lotions. Nanoparticle-based fabric coating allows production of stain-resistant textiles. But most big applications on a widespread basis will take another five years and they will continue to grow beyond that.

Some commercial firms with known big names in the nano area are Samsung, NEC, Mitsubishi, HP, IBM and DuPont. Of course, there are a lot of small start-ups in the US and other countries in this area as well.

**How far advanced is Asia in the game? What about other geographical regions?**

I think Asia is holding its end. Japan is certainly a leader and they spend the most on nano research. South Korea has a lot of re-



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search activities at universities, government institutes and companies. I also see a lot of research in Chinese universities.

European Union countries have recognised the importance of nanotechnology and do not want to lag behind the US. One cannot really say who is in the lead right now. This is tough to measure. You can use the

publication of articles in prestigious journals as a measure, but is that truly an economic indicator? Probably not. What about patents? Perhaps that is a better indicator. But since the patent processing takes a full three years, it is hard to know what is in the pipeline in every country.

**What is the full potential of nanotechnology, economic and otherwise?**

Based on what I said about nano being an enabling technology and its ability to impact numerous sectors, the expected impact is huge. Reports from the US government's National Science Foundation indicate a trillion-dollar economy in the coming decades.

**Fears have also been raised about the potential ill effects of nanotechnology on health and the environment, among other things. What are your views on this?**

Fears and ill effects have been there about every technology since the beginning of civilisation. Guns, a 19th-century technology once necessary to hunt for food, kill people. Look at all the pollution, environmental and health problems resulting from the macro industries such as chemical, power, petroleum, coal and other industrial plants. Nano, I am sure, will have some distractions since it is a far-reaching technology impacting various sectors. However, as with everything since the industrial revolution, the role of the governments should be to protect and guard the public's safety. ■

*Meyya Meyyappan will be on the GlobalTRONICS Summit discussion panel on Sept 7 and will make an address on the application of nanotechnology at the GlobalTRONICS Technology Conference on Sept 8. Both events will be held at Suntec Singapore.*