<< go to Roundtable Attendees

BUILDING CONSTRUCTION
TECHNOLOGY ROADMAP

APPENDIX A

What is Nanotechnology?

Author: Carl Masens, Institute for Nanoscale Technology, University of Technology, Sydney
20 July 2004

APPENDIX A:

What is Nanotechnology?

Many of the technologies mentioned in the focus groups that will impact upon the built environment by 2024 fall into the category of nanotechnology. So that the reader will have some point of reference we have included this short note of explanation.

The prefix “nano” refers to the 10-9 length scale, ie. one millionth of a millimeter. Nanotechnologies are therefore those technologies that feature some exploitation of the size-dependant physical phenomena that arise only in the 1-100 nm size regime. As a consequence, much of chemistry, while involving components that are of that scale, does not fall into the nanotechnology basket.

The properties of any manufactured item are a consequence of the materials of which it is composed. While the previous statement would seem obvious to most readers, it is worth making the point that a revolution in materials science will have the inevitable consequence of bringing dramatic change to a vast array of manufactured goods.

Nanotechnology has emerged as a promising area of research only after the development in the 1980s of instrumentation that allows measurement of surfaces with atomic resolution (the scanning tunneling microscope), in combination with advances in computer science that have enabled numerical solution of the quantum mechanical equations that describe molecular systems. Of course there are many other important enabling developments, instrumentation and computation are primary.

Many quite different technologies share this length scale and so it is not really possible to equate nanotechnology with any single specific example. Most useful is to note that coating technologies are currently (2004) the recipient of many new developments, where the performance improvements are in the areas of:

- optical and thermal properties
- surface chemistry control (e.g. hydrophobic and oliophobic materials)
- self cleaning
- self sterilization
- corrosion resistance
- UV protection.

The above are being applied in the following ways:

- thin coatings applied to glass for the purpose of heat reflection, opacity control, self cleaning, energy harvesting
- self cleaning coatings for ceramic tiles, stone, glass and metals
- stain and wrinkle resistant textiles
- UV protection in polymers.

The house of the future will contain within its structures many new materials both in the structural elements and in the decorations, furnishings and fittings. One of the most profound developments will be the advent of smart materials featuring embedded technology.

Embedded technology refers to the incorporation of millions of tiny devices in the physical infrastructure of a building (e.g. mixed into paints, “spun” into fibres). These devices will be sensors and computers, and will be used to monitor at high spatial resolution a wide range of modalities such as air quality, temperature, stress/strain, sound, pressure, optical spectra, and more. Smart homes will feature the convergence of information of all kinds (telephony, entertainment, internet etc) in a digital paradigm where the building will be “run” by an operating system. Since the computing is distributed (e.g. in the paint) there is an inherent crash-proofing of the OS. Such embedded devices will be impossible to connect to via wires and will need to be wireless in their communication and energy scavenging for their power. The tiny size dictates that individual device power consumption will be small, and similarly any wireless signal strength will be miniscule. The use of embedded technology allows a dynamic self-optimising building that can keep itself running with the low energy consumption and a healthy indoor environment.

For more information on this subject please refer to http://nano.uts.edu.au.

BUILDING CONSTRUCTION
TECHNOLOGY ROADMAP

APPENDIX A

END

go to Desktop Study Report >>