Entering the nano world

Some of our SciBar participants prepared this glossary, independently of Professor O'Brien. Your feedback on the level of information and usefulness of the SciBar glossaries is most welcome.

Artificial photosynthesis A dream of chemists to emulate plants by creating a nano-device to absorb solar energy and use this energy to drive chemical reactions, e.g. to synthesise fuels.

Fullerene Cage-like structure of at least 60 carbon atoms bonded together. Fullerenes or 'bucky balls' of 60, 70, 72 and 84 carbon atoms have been identified.

Hybrid solar cell Solar cell using thin layers of polymer semiconductors and semiconductor nanoparticles. The cells could be cheaply mass produced by spraying or printing thin films on a plastic backing. The nanoparticle layer contains semiconductor quantum dots.

Nano A prefix meaning one billionth (1/1 000 000 000).

Nanofabrication Manufacturing materials with dimensions less than 100 nm, either 'bottom up' (placing atoms or molecules one at a time) or 'top down' (etching a piece of material by chemical methods or mechanically using UV light, X-rays or electron beams).

Nanometre (nm) One billionth of a metre, or a millionth of a millimetre (10^{-9} metre). One nanometre is about the length of 3–6 atoms placed side by side, or about 100 000 times smaller than the width of a human hair.

Nanoparticle Particles 1–100 nm in size, which have substantially different chemical, physical and electronic properties from those of the corresponding 'macroscale' material due to the unusually high surface to volume ratio.

Quantum dots Semiconductor nanoparticles. Their chemical, electrical and optical properties can be manipulated by controlling the size of the particle. For example, solutions of quantum dots fluoresce at a particular colour depending on the size of the dot. Quantum dots also absorb light (again, tunable by size), and could be used in new solar cell technologies.

Scanning probe microscopy A technique that 'feels' an atomic-scale surface by moving a probe over the surface in a series of precisely measured lines and records how the probe interacts with the surface. For example, a scanning tunnelling microscope detects an electric current flowing from the surface to the point of a fine metal probe.

Useful weblinks:

http://mrsec.wisc.edu/Edetc/background/nano.html Exploring the nanoworld: series of topics written a couple of years ago giving general background. Looks incomplete initially, but if you dig under 'More' there are useful slide sets e.g. on 'what is nanoscale', societal implications, quantum dots and nanoparticles, applications and nanoscale devices (including molecular motors and solar cells), carbon nanotubes and buckyballs.

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Don't forget that there are TWO SciBars in June!!

During the Barnaby Festival in Macclesfield, on Sunday 19 June at the Park Tavern in Macclesfield, Roger Barlow will reprise his popular Bollington SciBar talk on Antimatter. Time: 6.30pm as usual – note one-off venue.