Graphene

One of our SciBar participants prepared this glossary, independently of Dr Aravind Vijayaraghavan. Your feedback on the level of information and usefulness of the SciBar glossaries is most welcome.

Electron mobility How easily electrons move through a material. Graphene has the highest electron mobility of any substance. Electrons at room temperature can move thousands of interatomic distances without scattering (colliding). This would make graphene transistors smaller and run faster than silicon.

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. Fullerenes are very strong and stable because of their structure.

Graphene A sheet of carbon atoms bound together in a regular hexagonal ('honeycomb') pattern only one atom thick. The most electrically conductive material known and also the strongest material known, and is 97% transparent and very flexible.

Graphite A form of carbon that occurs naturally and is used in pencils. The structure of graphite is a stack of layers that slip over each other easily. In each layer carbon atoms are bonded tightly together in a regular hexagonal pattern. Graphene can be produced from graphite by pulling single layers from graphite.

Hole The absence of an electron in an atom or atomic lattice. See *semiconductor*.

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.

Nanotube Cylindrical carbon molecule, with walls formed by graphene sheets and with a diameter of about 1 nm. Conduct electricity and also have a very high surface area.

Semiconductor Substance with an electrical conductivity between that of a conductor and an insulator. Examples are carbon in the form of graphite and grapheme, and the elements silicon and germanium. In semiconductors, an 'energised' electron is able to move from atom to atom in the material, producing an electric current. The spaces left by the wandering electrons are called 'holes', and can be filled by electrons from nearby atoms.

Transistor Semiconductor devices used as either tiny amplifiers or high-speed switches within integrated circuits. Graphene transistors for computer chips will be faster than silicon-based transistors, and use less power.

Useful weblinks:

"Could graphene be the new silicon?" Article from November 2011, http://www.guardian.co.uk/science/2011/nov/13/graphene-research-novoselov-geim-manchester

"Carbon flatland" http://royalsociety.org/summer-science/2011/carbon-flatland/ (links to an image gallery, video interview with the Nobel prize winners, journal papers)

Next Bollington SciBar: 11 February 2013, "Infinity". Time: 6.30pm as usual at the Vale Inn.

Next Macc SciBar: 28 January 2013: "Do we need shale gas?" Time: 6.30pm as usual at the Park Tavern