

“Nanotechnology: Seven Wonders of a Small World”
Professor Richard Palmer
University of Birmingham

Professor Palmer started simply enough by getting the audience to remember the seven wonders of the ancient world, one or two of which he would use as links to his subject. However he plunged straight into the world of very small materials – those ranging in size from 10 – 300 nanometres (nm) and for reference he said that a human hair was about 80,000 nm thick.

With consummate skill he dazzled the audience with a “simplified” overview of just seven applications of nanoscience, both academic and practical.

A “nano-colossus” only 300nm high was created from the dissociation of residual oil molecules in the high vacuum system of a scanning tunnel electron microscope. This demonstrated how it is possible to “grow” very small structures. Accurate grids 20 x 20 nm square and up to 160nm deep have also been created from the conversion of C₆₀ Buckminsterfullerene molecules into graphite.

It has been shown that individual atoms of materials such as gold and silver can form “magic number clusters” that act as stable shell structures. These clusters of 8, 14, 20, 55 etc. can now be attached to surfaces and grown into lateral structures that can be used as templates or bio-interfaces. Coating clusters with polymers makes it possible to grow pillars of materials such as silicon that can be made to emit visible light, hence the description “nano-lighthouses”!

Molecules of the chaperonin type attached to gold clusters make it possible to study the folding of protein molecules. Biochips that have immobilised protein molecules on their surface can be used for the early detection of low level cancer proteins. Nano techniques have now made it possible to achieve atomic manipulation at room temperature. A single molecule of chlorobenzene can be lifted off and moved around a surface. It is also possible to excite the molecule in such a way that the chlorine atom is split off thus enabling the study of single electron reactions.

This stimulating lecture provided a wonderful introduction to the world of very small materials.

Given on Wednesday 9 May 18 at the Royal Agricultural College