What can nanosurface materials do for us?

Interfacing with the nanoworld

Nanomaterials promise a revolution in many areas of life, from electronics, to sensors and healthcare, industrial materials, food, security and transport. By reducing power consumption, device size or air pollution, or increasing the velocity of data transfer.

However if we are to use nanomaterials, how do we, in our 'macro' world, interact with them? We need **interfaces**. For many of these applications it is necessary to connect with nanomaterials, for example if we want to make a single molecule transistor. For this a detailed understanding and control of the interface between nanomaterials and their environment is critical.

New tools, new insights

The engineering of surfaces and interfaces of nanostructures remains a central goal of modern solid state physics and chemistry, since atomically controlled interfaces play a key role in the performance of nanodevices. Limitations in characterisation and theoretical modeling tools have been a major obstacle to the development of controllable device interfaces.

Prior to this Action, the necessary experimental and theoretical tools to engineering the necessary interfaces simply did not yet exist. One of the key goals of COST Action MP0901 'NanoTP' was to develop these tools and the associated expertise. So the main objective of the Action was **atomic-scale interface design and characterisation**.

With the involvement of over 173 scientists from 25 countries, **this Action combines the development of new tools with the expertise needed to exploit them for improved nano-interface control and novel device design**.

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Results and objectives in the fields of nanomaterials

NanoTP is a **unique hub of scientists** in that its foundations are built on a number of **smaller informal networks of researchers**. This helps to structure and streamline research at the national level with the support of the surrounding European scientific community.

These central cores of excellence have then been brought together through a series of workshops and conferences, and an increasing number of scientific exchanges between groups. One example is the GraphITA conference coorganised by NanoTP at l'Aquila, Italy, in May 2011. This event successfully brought together the Italian graphene community, while drawing in major European experts (with the participation of Konstantine Noveselov, 2010 Physics Nobel Laureate for his work on graphene).

More specifically, NanoTP in collaboration with researchers from the German synchrotron (Helmholtz-Zentrum) in Berlin adapted an x-ray microscope to perform spectroscopy in isolate nano-objects. This new method combined with nano-tomography opens the way to study systems such as the interaction of nanostructures with biological cells, or complex organic hybrid nanomaterials.

Another example of the success of this Action are the recent studies by NanoTP members and colleagues which have shown how nanomaterials can change and transform under an electron beam; this should lead to new developments which will allow us to simulate systems over 100 times larger than previously possible.

The implications of these developments will be highly significant, as this approach will support the design and integration of novel materials of high technological relevance.

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