One-atom-thick materials promise a 'new industrial revolution'

July 21 2005

Scientists at The University of Manchester have discovered a new class of materials which have previously only existed in science fiction films and books.
A team of British and Russian scientists led by Professor Geim have discovered a whole family of previously unknown materials, which are one atom thick and exhibit properties which scientists had never thought possible.

Not only are they ultra-thin, but depending on circumstances they can also be ultra-strong, highly-insulating or highly-conductive, offering a wide range of unique properties for space-age engineers and designers to choose from.

Professor Andre Geim said: "This discovery opens up practically infinite possibilities for applications which people have never even thought of yet. These materials are lightweight, strong and flexible, and there is a huge choice of them. This is not only about smart gadgets. Like polymers whose pervasiveness changed our everyday life forever, one-atom-thick materials could be used in a myriad of routine applications from clothing to computers."

The materials have been created by extracting individual atomic planes from conventional bulk crystals by using a technique called 'micromechanical cleavage'. Depending on a parent crystal, their one-atom-thick counterparts can be metals, semiconductors, insulators, magnets, etc. Previously, it was thought that such thin materials could

not exist in principle, but the research team have, for the first time, demonstrated that they are not only possible but fairly easy to make.

They found that the atomically thin sheets they extracted were not only stable under ambient conditions but also exhibited extremely high crystal quality, which is what gives them their unique properties.

Dr Kostya Novoselov, a key investigator in this research, added: "Probably the most important part is that our discovery is not limited to just one or two new materials. It is a whole class of new materials, thousands of them. And they have a variety of properties, allowing one to choose a material most appropriate for a particular application.

"Although some of the applications are probably decades away, I expect to see ultra-fast transistors, micromechanical devices and nano-sensors based on the discovered one-atom-thick crystals already in a few years time."

The findings are published on 18 July, 2005 in the *Proceedings of the National Academy of Sciences*. The paper is entitled: 'Two Dimensional Atomic Crystals'. In conclusion it reads: "We have now demonstrated the existence of 2D atomic crystals and believe that, once investigated and understood, it will be possible for them to be grown in large sizes required for industrial applications."

Source: University of Manchester