Carbon Electronics

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NEC Nano-Electronics Centre

UNIVERSITY OF SURREY

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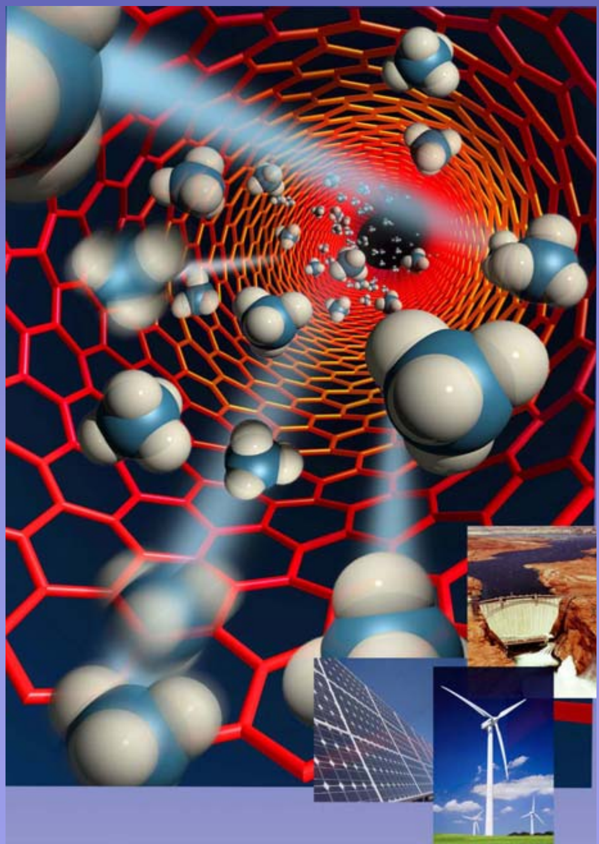

About the speaker:

Professor Ravi Silva is the Director of the Advanced Technology Institute at the University of Surrey and heads the Nano-Electronics Centre, which is an interdisciplinary research activity. The NEC has over 50 research staff, and is one of the leading laboratories in carbon based electronics worldwide. The activity was identified and awarded an EPSRC Portfolio Partnership award in Integrated Electronics valued at over £6M in 2003. Prof. Silva joined Surrey in 1995, prior to which he was at the Engineering Department at Cambridge University for his undergraduate and postgraduate work. His research has resulted in over 355 presentations at international conferences, and over 330 journal papers. He is the inventor of 20 patents, including a key patent on low temperature growth of carbon nanotubes, and one on the fabrication of large area nanotubes-organic solar cells. The research conducted has already resulted in two spin out companies backed by venture capital funding. One of the companies, Surrey NanoSystems Ltd., won the spin-out company of the year 2007 award from the Engineer Magazine. In 2001 he was awarded the Charles Vernon Boys Medal by the Institute of Physics, and in 2003 awarded the IEE Achievement Award by the Institute of Electrical Engineers. In 2003, he was awarded the Albert Einstein Silver Medal and Javed Husain Prize by UNESCO for contributions to electronic devices.

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Abstract

The world we live in today is dependent on silicon to conduct all of its information processing and transmission of data for a modern lifestyle. But, what happens beyond silicon CMOS? Moores Law indicates that the exponential increase in device components on a chip and increased speed in processing seen annually must come to an end in the next decade with conventional silicon.

Carbon may prove to be the dark horse, which can overcome many of the barriers observed in conventional CMOS and in this talk I will develop the thesis as to why such a technology may become the standard in 2 or 3 decades.

Within this talk we will explore the issues pertaining to the use of carbon as an electronic material. Also, how we can use the versatility in its bonding hybridisation to produce nanotubes and sheet of materials that have unique properties to beat the current limits of silicon.

Since 1991 carbon nanotubes (CNT) have generated much interest and excitement in the science and technology community due to its unique physical and materials properties. Its physical structure, and high aspect ratios have given rise to quantum phenomena being observed at room temperatures, and given new insight to device physics. Since then, in 2004, with the separation of graphene an ID sheet of material with quasi-ballistic electrons has become available to researchers. In this talk, I will discuss some of the research we have conducted in the growth, nano-manipulation and functionalisation of carbon nanotubes, and by suitable design how novel platforms can be created for technological applications including nano-biology. Some preliminary work on graphene transistors will also be introduced.

The mixing of CNT with organics also opens a plethora of applications in solution processable hybrid structures, which could be exploited for the production of large area solar cells and lighting devices. Issues associated with low charge carrier mobilities and low diffusion lengths of excitons in the organics can be overcome within the hybrid structures by having ‘inorganics-in-organics’ to improve on the efficiency of the devices. The electronic properties of CNT are fundamentally dependent on its atomic structure, and understanding the interactions at this level through STM studies has allowed us to better design systems that incorporate CNTs as active materials. The ability to functionalise CNTs inside and outside its tubular structure allows this material greater flexibility than most in providing a platform for future technology applications in electronics, optical and biological fields.

More information on the research can be obtained from our group website andpublications found at:
http://www.ee.surrey.ac.uk/NEC