Conference “Nanotechnology”

Date: 25/02/2010

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Curriculum vitae

Edmund Leary received his PhD in Chemistry from the University of Liverpool, UK, in 2008, where he also obtained his Masters’ degree in Chemistry in 2004. In 2009 he began working at the Instituto Madrileño de Estudios Avanzados (IMDEA) Nanociencia Foundation - a joint initiative of the regional Government of Madrid and the Ministry of Science and Education of the Government of Spain. His research interests lie in the field of Molecular Electronics, and in particular studying how single molecules conduct electricity. He has eight publications to his name so far and has presented his work at several major international conferences.

Dr. Leary has six publications to his name in both chemistry and physics specific journals. Specific examples are: “Single-Molecule Solvation-Shell Sensing”. Leary, E; Hobenreich, H; Higgins, SJ, et al. PHYSICAL REVIEW LETTERS, Volume: 102 Issue: 8 Article Number: 086801 Published: 2009, and “Chemical control of double barrier tunnelling in alpha, omega-dithiaalkane molecular wires”. Leary, E; Higgins, SJ; van Zalinge, H, et al. CHEMICAL COMMUNICATIONS, Pages: 3939-3941 Published: 2007.

He has presented orally his work at several international conferences including the Internationl Society of Electrochemistry meeting held in Dublin in 2007 and the European Conference on Surface Science in Liverpool, UK, in 2008. Recently he attended a conference specifically about Molecular Electronics in Switzerland (2010).

In the near future he will present his work on Fullerene based nanocircuits at the Electrochemical Society’s annual meeting in Vacouver, Canada.

Nanotechnology

Dr. Edmund Leary

Instituto Madrileño de Estudios Avanzados (IMDEA) Nanociencia Foundation

50 years ago Richard Feynman, now infamously, said “There’s plenty of room at the bottom”. He was saying that we could do fantastic things by directly manipulating atoms and molecules, the building blocks which make up you, me and practically everything around us, if only we knew how. Since those lectures, however, nanotechnology, the study and manipulation of things on the scale of one billionth of a meter, has, and remains, a huge challenge for scientists. Not only are the means by which to study such small entities as atoms and molecules technically demanding, but the nanoworld is the gateway to the quantum world, a world which runs quite differently to our macroscopic domain. In the first part of this lecture we must journey into this strange quantum world and conquer its forces if we wish to control our atoms and molecules to for our own benefit. In particular, in 1981, a special instrument was invented which allowed scientists to perform very delicate manipulation of matter. It is called the Scanning Tunnelling Microscope (STM) and it relies on a very strange property indeed – tunnelling. With it we can see atoms and molecules and then move them about in a controlled fashion. It initiated the mainstream interest in nanotechnology and we shall discuss the important aspects of this amazing machine.

In the second part of this lecture we shall talk about an aspect of nanotechnology which could transform our electronics industry – molecular electronics. This involves wiring up appropriately designed molecules in circuits and using them to control the current flowing around the circuit. Nowadays, with the rapidly advancing silicon based semiconductor industry approaching its theoretical limit, in terms of the size reduction of components, molecular electronics is set to become the best alternative approach to current silicon technology. It may also reduce the cost of many electronic applications because of the use of carbon based molecules. However, one area in particular, molecular photovoltaics, or molecular solar cells, could be the answer to the World’s energy crisis. We shall finish by looking at how scientists are trying to tackle this far reaching application of nanotechnology.

Vocabulary

Semiconductor	Transistor	Resistance
Silicon	Rectifier	Moore´s Law
Silicon Road Map	Lithography	Quantum mechanics
Fullerene	Nanowire	Scanning Tunnelling Microscope
Carbon Nanotube	Nanosensor	
Self assembly	Conductance	

Recommended Reading

- "Nanotechnology For Dummies"*****. Richard D. Booker and Mr. Earl Boysen. Wiley, 2005
- "Soft Machines: Nanotechnology and Life". Richard A. L. Jones. Oxford University Press, 2008
- "Understanding Nanotechnology". Scientific American, 2002
- "Introduction to Nanoscience". Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta, and Anil Rao. CRC Press, 2008
- "Introduction to nanoscale science and technology". Massimiliano Di Ventra, Stephane Evoy, and James R. Heflin. Springer, 2004
- "Nanoscale science and technology". Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan. Wiley, 2005
- "Feynman and computation: exploring the limits of computers". Anthony J. G. Hey. Westview Press, 2002
- "Plenty of room for biology at the bottom: an introduction to bionanotechnology". Ehud Gazit. Imperial College Press, 2007

***** *Un ejemplar de este libro será sorteado al finalizar la conferencia entre los asistentes a la misma.*