



SEMINAR

Professor Sir Colin Humphreys, CBE, FREng, FRS

**Professor and Director of Research
Department of Materials Science and Metallurgy
University of Cambridge**

Thursday 29 November, 2012
3.00pm – 4.00pm
Science Lecture Theatre S14, Building 29

Professor Humphreys will present two short seminars as follows:

Exploiting University Research - A Case Study in Gallium Nitride LEDs

This talk will describe the importance of LEDs for saving energy, outline how LEDs work and then give a case study of the exploitation of the research of my group, going from basic science research through to setting up start-up companies and then transferring the technology to Plessey, which plans to manufacture 500 million LEDs per annum in the UK. This is the first major new manufacture of a semiconductor device in the UK for many years. In this case, the exploitation of my research has been an almost random-walk process! However, some key points have emerged, such as the importance of long-term funding of the basic science, the importance of publicising one's results at conferences and elsewhere, the importance of advice on setting up a small company and the importance of being in the right place at the right time!

Carrier Localisation and Efficiency Droop in GaN LEDs and GaN LEDs on 6-inch Si

Why are GaN LEDs so efficient when the defect density is so high? Scientists thought they knew the answer to this question. However, the research of my group has shown that the universally believed answer was wrong and a combination of electron microscopy and atom probe tomography has revealed the correct answer: the electrons and holes are in different localised states in the InGaN quantum wells. Electron microscopy and atom probe tomography data has been fed directly into quantum mechanical modelling to determine the nature of the localisation sites. We believe this model also explains the so-called efficiency droop at high current densities. The problem of growing GaN on large-area Si wafers is then discussed and electron microscopy again has had a key role to play. Our increasing understanding of GaN and InGaN looks likely to enable GaN-based lighting to become the dominant source of lighting throughout the world.

Convenor: Professor Joanne Etheridge
Email: mcem@monash.edu: Tel: 9905 5563

Visitors are most welcome: Please note the parking arrangements. There is a designated Visitors Car Park (N1) clearly ground-marked by white paint and tickets, at a cost of \$7.70/day, are available from a dispensing machine. ('Blue' permit designated areas are for Monash members only). It is also possible to park at other designated Visitors Car Parks (E1, S1 and S2) on the Clayton Campus, but tickets are \$3.30/hour.

BIOGRAPHY



Professor Sir Colin Humphreys, CBE, FREng, FRS is the former Goldsmiths' Professor of Materials Science and current Director of Research in the Department of Materials Science and Metallurgy at the University of Cambridge; Professor of Experimental Physics at the Royal Institution in London; Professorial Fellow at Selwyn College, Cambridge.

His research interests include all aspects of electron microscopy and analysis, semiconductors (particularly gallium nitride), ultra-high temperature aerospace materials and superconductors. Professor. Humphreys has received numerous honours and awards, including the Kelvin Medal and Prize, Institute of Physics (1999); the European Materials Gold Medal, Federation of European Materials Societies (2001); and the Robert Franklin Mehl Gold Medal, The Minerals, Metals and Materials Society, USA (2003).

He is Founder and Director, Rolls-Royce University Technology Centre on Advanced Materials, Cambridge; and Founder and Director of the Cambridge Aixtron Centre for Gallium Nitride; past-President, Institute of Materials, Minerals and Mining and in 2010 he became the Master of the Armourers and Brasiers' Company in London, whose charity, the Gauntlet Trust, is the largest charity supporting materials science in the UK. He has also held positions in various UK government agencies, including The Technology Foresight Committee of the Dept of Trade and Industry.

Professor Humphreys is also very involved in the public understanding of science, having served as Selby Fellow, Australian Academy of Science (1997); as Fellow in the Public Understanding of Physics, Institute of Physics (1997-99); and as President of the Physics Section of the British Association for the Advancement of Science (1998-99).

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