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Characterisation of Ion Implanted Channels in Diamond with Dual EELS

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Abstract

Amorphous carbon has both sp^2 and sp^3 bonds and its physical properties are determined by sp^2/sp^3 ratio. Ion beam induced amorphisation in diamond results in formation of disordered carbon regions with variable sp^2/sp^3 ratios through transition of some broken sp^3 bonds into more stable sp^2 bonds with corresponding density reduction. Electron energy loss spectroscopy (EELS) has been widely used to study bonding in many carbon systems. EELS is the analysis of the energy distribution of electrons that pass through a thin sample and interact inelastically with it. EELS detector is typically incorporated into a transmission electron microscope (TEM) or a scanning TEM (STEM). EELS data consists of either detailed, energy loss spectral information from the sample (spectroscopy) or images that have contrast created by electrons that undergone selected energy losses in the specimen (energy-filtered TEM). In new generation of energy filter, Gatan Inc. introduced Dual-EELS technique which allows to acquire two electron energy loss spectra from different energy ranges (typically one core-loss and one low-loss) in rapid succession. When you have both the core- and low-loss signals from an identical sample area, additional processing methods become practical. These additional methods include: removal of energy shift to allow accurate chemical shift measurements; assess sample thickness; correlate low-loss signals with core-loss features.

In this talk I will overview of results of TEM and EELS study of ion beam induced amorphisation in diamond conducted at Advanced Microscopy Facility (University of Melbourne). Dual EELS capability for characterisation of implanted channels will be demonstrated.

The speaker



Sergey Rubanov received his M.Sc. in Physics from Novosibirsk State University, Russia and his Ph.D. in Materials Science from University of NSW, Australia. Between 2003 and 2006 he was part of team at Centre for Quantum Computer technology at School of Physics University of Melbourne. Since 2006 Sergey has been senior research fellow in the Advanced Microscopy Facility at the Bio21 Institute, University of Melbourne. He is supervising research activities of Nova dual-beam focused ion beam system and Tecnai F20 transmission electron microscope. His current research interests are focuses on ion implantation, radiation damage and recrystallization, direct nanofabrication with FIB.