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NANOSCIENCE COLLOQUIUM

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Energy Loss Spectroscopy at High Resolution: State-of-the-art and applications in Semiconducting Nanostructures

Electron energy loss spectroscopy (EELS) is an invaluable technique to study the detailed structure and the chemical state of materials at unprecedented spatial resolution. Today, this technique is used “routinely” to characterize nanoscale materials used in a myriad of applications from energy storage and conversion, to solid-state devices and biomaterials interfaces. In this presentation I describe recent developments in EELS, showing that is possible to probe the changes in bonding and coordination of atoms on surfaces, and the valence changes in complex crystals at atomic resolution.

In the area of semiconducting materials, I will show examples of detailed studies of point defects in Si generated by shallow Indium ion implantation, comparing the experimental structure with detailed molecular dynamics experiments with nearly perfect agreement. I will discuss the growth of InAs nanowires on stepped InP substrates, also showing very good agreement between the kinetics Monte-Carlo growth simulations and experimental data. I will then describe structural analysis of GaN dot-in-wire nanostructures used for LED and Laser applications demonstrating how quantitative EELS information and local strain measurement of piezoelectric effects can be correlated to optical properties and recent cathodoluminescence data of individual dots.

Host: Crispin Hetherington (Centre for Analysis and Synthesis)