MONASH University

Monash Centre for Electron Microscopy

Monash Centre for Electron Microscopy Seminar

Low-voltage electron transmission in a field-emission scanning electron microscope

FRIDAY 21 SEPTEMBER, 2018

11.00AM – 12.00NOON

Lecture Theatre S9, 16 Rainforest Walk, Monash University Clayton Campus

Presenter

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ABSTRACT

With consistently new and improving technologies, transmission imaging of thin specimens is no longer reserved to high-energy conventional transmission electron microscopes (TEM). Low energy imaging can now be performed in field-emission scanning electron microscopes (FE-SEM). This enables the possibility of transmission imaging at accelerating voltages around 30 keV and lower, which can reduce knock-on beam damage of fragile materials. Which this, new experimental and simulation methods must be devised in order to ensure proper data analysis and to widen the scope of the use of SEMs for characterization purposes. In this talk, various simulation and experimental methods pertaining to low voltage electron transmission are discussed. A novel approach to diffraction simulations is proposed using a time-dependent wave packet propagation scheme coupled with computations of quantum trajectories [1]. This method demonstrates the quantum flow of the wave function inside the material and can be used for calculations such a as beam broadening and thermal diffuse scattering (TDS) in the low energy regime. Furthermore, exit wave reconstructions are presented using a series of defocused experimental images obtained using a Hitachi SU9000, where it is shown that a variety of image parameters may be improved in dark field and secondary electron imaging [2]. This method also outputs the phase of the wave function which can aid in further imaging techniques. Finally, work on electron energy loss spectroscopy (EELS) at 30 keV demonstrates the potential of light element detection in an SEM.

References

[1] S. Rudinsky, A. S. Sanz, and R. Gauvin. A novel quantum dynamical approach in electron microscopy combining wave-packet propagation with Bohmian trajectories. Journal of Chemical Physics, 146:104702, 2017.

[2] L.J Allen, W McBride, and M.P Oxley. Exit wave reconstruction using soft x-rays. Optics Communications, 233(1):77 { 82, 2004.

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