



Centre for Research in Nanotechnology & Science Sophisticated Analytical Instrument Facility IIT Bombay

Scanning Transmission Electron Microscopy (STEM) and related techniques



Dr. Mohamad Riza Iskandar

Application Scientist
Thermo Fisher Scientific



**12th January 2021
(Tuesday)**



11:00 am to 12:00 noon



**Platform
(Microsoft Teams)**

Abstract :

The scanning transmission electron microscopy (STEM) is a technique that opens the possibility of performing atomic-resolution imaging and nanoscale analysis. This technique uses a focused electron beam to scan over the specimen in a raster pattern similar to the more widely known scanning electron microscopy (SEM). In contrast to an SEM, where a bulk sample is typically used, as STEM uses detectors after the specimen, it requires an electron-transparent specimen, usually less than 100 nm thickness. Although the sample preparation requires more effort than SEM's sample, combining a very fine electron beam produced by STEM with an electron-transparent specimen, an atomic arrangement can be revealed on high-resolution STEM images. These HRSTEM images will give more information as they show chemical contrast when acquired using a high-angle annular dark-field (HAADF) detector, thus making image interpretation easier than the conventional HRTEM images. Thermo Fisher Scientific has also developed a new image formation method in STEM known as integrated differential phase contrast (iDPC). The iDPC method exposes low-Z elements with bright contrast and dark background, placing considerably less dependence on defocus and/or thickness. As a result, all elements of the periodic table, such as lithium and hydrogen, can be imaged using the iDPC method. STEM also opens the possibility to collect diffraction patterns in scanning mode. This technique, known as scanning nano electron diffraction (SNED), allows diffraction patterns from areas as small as 1 nm to be collected. The SNED gives the smallest area diffraction compare to other convergence beam techniques such as convergence electron beam diffraction (CBED). Combining STEM with other chemical analysis techniques such as energy-dispersive X-rays spectroscopy (EDS) or electron energy loss spectroscopy (EELS) local probing up to atomic scales, such as elemental maps of 2D atomic arrangements, is possible under analytical electron microscopy (AEM) techniques.

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Organizer: Prof .Anil Kottantharayil
Head, Department of SAIF/CRNTS, IIT Bombay.
For queries email id: workshop.crnts@iitb.ac.in

Coordinator: Ms. Aradhana P.Naudiyal with Electron Microscopy Webinar Team.