Session: AS+NS-TuA4 | Nanoparticle Characterization using Advanced FESEM/STEM and XPS Instrumentation | **Abstract # 361**

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Abstract:

Transmission electron microscopy (TEM) and field emission scanning electron microscopy (FESEM) are valuable tools for characterizing the structure, morphology, and composition of nanoparticles and nanostructures. TEM can provide high-resolution imaging, crystallographic information, and elemental composition, when combined with energy dispersive X-ray spectroscopy (EDS), but no detailed surface information. FESEM on the other hand, can provide extremely detailed information on surface morphology. Combining the high resolution secondary electron imaging capabilities of FESEM with TEM data to utilize the strengths of each technology provides the opportunity to more fully and accurately characterize nanomaterials. However, the process of transferring samples between separate FESEM and TEM instruments and relocating such small particles is time consuming and tedious. Recently, Hitachi commercialized a high resolution electron microscope that combines the benefits of FESEM and low-kV scanning transmission electron microscopy (STEM) in a single instrument (Model S-5500).

The electron optical design of the S-5500 places the sample at the optimum analytical and imaging working distance. This allows simultaneous acquisition of high-resolution FESEM and STEM images, as well as EDS information. Therefore, a variety of signals can be collected simultaneously including secondary electron and backscattered electron FESEM images and bright field (BF) and dark field (DF) STEM images. Combining this instrument with new silicon drift detector (SDD) technology (Bruker 30 mm^2) allows for high resolution elemental analysis and mapping of nanostructures.

X-ray Photoelectron Spectroscopy (XPS), also known as Electron Spectroscopy for Chemical Analysis (ESCA), is a highly surface-sensitive and quantitative technique for nanostructured materials characterization. Nanometer scale sampling depth and its ability to provide chemical state information makes XPS an ideal analytical technique for investigating the elemental and chemical composition of nanoparticles. Hence, XPS can provide valuable complementary information to high resolution electron microscopy studies of nanomaterials. This presentation will illustrate the power of using combined FESEM/STEM and XPS analysis through an examination of a variety of nanomaterials. Examples will include (among others): functional thin organic layers on metal surfaces, multi-layer thin film coatings on glass, activated carbon nanoparticles, antimicrobial metal nanoparticles, and carbon nanotubes containing nanoparticle metal catalysts.

Note: Requested an Oral Session.