

Nanoparticle size analysis using SAXS and XRD techniques

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X-ray techniques are often used to estimate the size of nanoparticles in the range of 1 – 100 nm, because the commonly used x-ray's wavelength, 0.154 nm for Cu K alpha radiation for instance, is close to the size of nanoparticles and sensitive to the change of their size, shape, structure etc. There are two techniques used to estimate the size of nanoparticles, Small Angle X-ray Scattering (SAXS) and X-Ray Diffraction (XRD) techniques. Both of them provide the estimated size but use different types of scattering. This means that additional information about the nanoparticles can be extracted by comparing the results from those two techniques.

The SAXS technique is based on diffuse scattering and whether or not the particles are crystalline does not make any significant difference in the size analysis results. On the other hand, the XRD technique is based on diffraction and sees only the crystalline part of the particles. Thus, if the XRD technique gives a smaller size than that given by the SAXS technique, it indicates that the nanoparticles have either an amorphous phase or different crystalline phase such as oxides on the surface.

The SAXS and XRD techniques are applied to nanoparticle samples and the difference of the results are discussed in this presentation.