

Seminar, Wednesday September 27th: 10³⁰; Salle Niels K. Hansen, CRM2, FST, Entry 3B, 3rd floor

In-situ Characterization of Nanoparticle Nucleation and Growth via Pair Distribution Function Technique

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Abstract

During the initial nucleation and growth of nanoparticles no Bragg reflections can be observed. Thus classical crystallographic techniques to determine a crystal structure cannot be applied. Nevertheless, the observed intensity of a diffraction pattern of any material, even a completely amorphous material, can be transformed into the Pair-Distribution-Function (PDF). This PDF is essentially a Fourier transform of the intensities and thus corresponds to a histogram of interatomic distances. The combination of high-energy X-ray beamlines with fast and large area-detectors allows to follow the changes in a diffraction pattern during the nucleation and growth of nanoparticles with outstanding time resolution.

The talk will give an overview of PDF measurements and analysis. The nucleation and growth of transition metal oxides nanoparticles will be presented. The data allow to follow in detail the initial nucleation and the subsequent changes of highly disordered preliminary structures into well-ordered nanoparticles.

As the PDF does not rely on Bragg intensities it provides detailed structural information on liquids as well. This will be illustrated by the influence of nanoparticle surfaces on the short range order in the surrounding liquid.