TECHNISCHE UNIVERSITÄT DRESDEN

IFMP Institut für Festkörper- & Materialphysik

Fakultät Physik

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IFMP Seminar

When: **14 January 2020, 14:50 h**
Where: **REC / C 213 H**

Speaker: **Dr. Ann-Christin Dippel**
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High Energy Materials Science

Title: **Local structure of thin films by total x-ray scattering and pair distribution function analysis**

Abstract:

Atomic pair distribution function (PDF) analysis has become a widely used and most effective tool to study the short-range order of materials that comprise some degree of disorder. The method is based on Fourier-transforming total scattering data, i.e. the entire diffraction pattern including Bragg reflections and diffuse scattering, into real space to calculate a histogram of interatomic distances. Reliable, high-quality PDFs are obtained from scattering data over a wide range in reciprocal space up to high momentum transfer Q, which is most conveniently achieved by use of high-energy x-rays of > 50 keV. So far, PDF analysis has routinely been applied to bulk systems such as powders and nanoparticles, but recently, it is more and more utilized in the investigation of thin films as well. Particular challenges for thin film PDF are the small amount of sample that is typically confined to less than 1 µm in thickness while being spread out in the other two dimensions on a substrate that is usually thicker by a factor of at least 1000. Different approaches to thin film PDF have been applied, including the exfoliation of the film from the substrate to perform a powder diffraction experiment or measuring the film on the substrate in transmission through film and substrate. For very thin films, however, surface diffraction type measurements under grazing incidence yield enhanced surface sensitivity regardless of the substrate thickness. At the same time, the film is preserved in its original form on the substrate. In this presentation, I demonstrate the benefits of grazing incidence PDF to investigate thin films of metals, metal oxides, metal-organic and organic compounds in various states from amorphous to polycrystalline. Depending on the material system, we obtained the local structure of layers as thin as a few nanometers at a time resolution of the order of seconds or less, which opens for in situ and operando studies in real time.

Eingeladen von Prof. Jochen Geck