

Colloquium Cukrovarnická

**Ve středu dne 1. března 2017 ve 14:00 hod.
ve Fyzikálním ústavu Cukrovarnická v seminární místnosti
(budova A, 1. patro)**

Analysis of crystal structures from single nanocrystals



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Our ability to determine crystal structure of almost any material underlies the advance of so many scientific disciplines and it has become so naturally accepted that we may be misled to believing it is an easy and always available procedure. However, even now, after more than hundred years of the development of structural crystallography, there are problems that are very hard or impossible to tackle. One of especially hard problems is the structure analysis of micro- and nanocrystalline materials. Examples of such materials are sintered ceramics, many framework materials (zeolites), many organic compounds, but also thin films grown on a substrate, with structures different from the bulk with the same composition. In these cases it is very hard or impossible to grow large crystals suitable for x-ray analysis, and available x-ray sources do not provide sufficient signal to record diffraction from a submicrometric crystal.

The solution to the problem is the use of electrons as the probing radiation. Electrons interact with atoms about a thousand times more strongly than x-rays, and diffraction patterns can be obtained from extremely small nanocrystals. Unfortunately, the strong interaction leads to complicated diffraction phenomena, which, until recently, hampered the possibilities to use electron diffraction for accurate structure analysis. The lecture will describe the developments in the field of electron diffraction over the past decade that changed electron diffraction from an essentially unsuitable tool to a commonly accepted and accurate method in structure analysis of nanocrystals. The lecture will also explain and put in broader context the recent publication (Science 355, 166), which demonstrates the accuracy of the method by locating the positions of hydrogen atoms in crystal structures of an organic and inorganic compound.