

General Information			
Course name	Structure characterization by X-ray based techniques	ECTS Credits	4
		Semester	summer
Aims			
<p>To understand basic concepts of the X-ray crystallography and X-ray powder diffraction. Be able to perform phase analysis, refine the value of the lattice constant and estimate the average grain size from raw diffraction data. To understand basic concepts of the synchrotron radiation and its properties. Get familiarized with selected scattering, spectroscopy and imaging techniques utilizing synchrotron radiation.</p>			
Contents			
<p>X-rays are a unique tool to characterize the atomic and electronic structure of many materials, including periodic/ordered and non-periodic/disordered systems. X-ray diffraction and scattering methods provide structural information of mainly periodic systems down to atomic resolution. The course is divided in two sections. The first part covers basic concepts of the X-ray crystallography and X-ray powder diffraction, which represents one of the most essential tools in the structural characterization of materials. The first part is complemented with a hands-on laboratory section which aims to prepare reader to be able to independently deploy the technique for use in own research. The second part of the course covers basics concepts of the synchrotron radiation. Perspective reader will learn about unique properties of synchrotron radiation and its use in various scattering, spectroscopy and imaging techniques. The layout of typical synchrotron beamline with all essential components (monochromator, mirrors, focusing lenses, slit systems, sample stage and detectors) will be presented. Experimental techniques such as Small Angle X-ray Scattering (SAXS), Pair Distribution Function (PDF), X-ray Absorption Spectroscopy and X-ray Computed Tomography will be introduced in more details. At the end there will be a lesson covering recent development in the emerging field of X-ray Free Electron Lasers (XFELs).</p>			
Evaluation			
Oral examination.			
Bibliography			
<p>V. K. Pecharsky and P. Y. Zavalij, „Fundamentals of Powder Diffraction and Structural Characterization of Materials“, Springer, New York, 2005. D. Attwood and A. Sakdinawat, „X-Rays and Extreme Ultraviolet Radiation: Principles and Applications“, 2nd Edition, Cambridge University Press, 2016. M. Watanabe, S. Sato, I. Munro and G.S. Lodha, „A Guide to Synchrotron Radiation Science“, Narosa Publishing House. New Delhi, 2016 U. Bergmann, V. K. Yachandra and J. Yano, „ X-Ray Free Electron Lasers: Applications in Materials, Chemistry and Biology“, The Royal Society of Chemistry, London, 2017</p>			