Powder Diffraction and Synchrotron Radiation

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Powder diffraction refers to the measurement of diffraction phenomena – commonly using X-ray, neutron or electron beams – from sufficiently numerous systems of loose particles ("powders") or bulk, nano- or micro-crystalline materials. As such, powder diffraction methods strongly rely on the basic diffraction theory presented in previous lectures (see G. Zanotti, X-ray Diffraction) and essential knowledge of crystallography and physics of radiation-matter interactions. Synchrotron Radiation (SR) sources provide unique opportunities to powder diffraction, ranging from basic scientific research to technological applications. Basic elements of SR, as previously presented in this School, are also indispensable background.
The lecture comprises two parts: first one will underline the advantages and peculiarities of Synchrotron Radiation X-ray Powder Diffraction (SR-XRPD) and present a synthetic overview of the most common and appropriate applications. The second part will focus on the study of nanostructured and highly defected materials, presenting a comparative analysis in terms of Reciprocal Space (Laue-Wilson) and Direct Space (Debye) methods. Selected cases of study will be briefly illustrated, whereas interested participants will find a more comprehensive list of articles in the references available with the copies of the lecture slides.

Suggested (possibly preliminary!) readings include:

– B. E. Warren, X-ray Diffraction (Dover, 1990). ISBN: 0486663175.
– A. Guinier, X-Ray Diffraction: In Crystals, Imperfect Crystals, and Amorphous Bodies (Dover, 1994). ISBN: 0486680118.

Dover paperback editions were quoted for both textbooks, as they are easily and inexpensively available via Amazon or similar bookseller, as well as most scientific libraries.