

Powder Diffraction for Average and Local Structure Analyses

BL44B2 (RIKEN Materials Science Beamline)

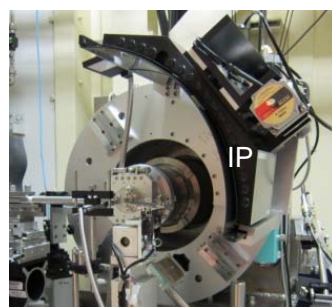
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Powder diffraction has been widely recognized as one of techniques for crystal structure analysis, which can provide a good knowledge of the long-range order (average) structure on the basis of Bragg scattering. On the other hand, the short-range order (local) structure involves diffuse scattering. In contrast to Bragg scattering, diffuse scattering generally forms extremely weak and broad reflections. In the last decade, high-brilliance and high-energy X-rays of third-generation synchrotron radiation (SR) sources have facilitated a so-called total scattering (a combination of Bragg and diffuse scatterings) technique, which have enabled the structural analysis of complex materials such as disordered and nano-structured materials by means of powder diffractometry.[1] There are some technical points to note for the SR total scattering data collection; therefore this practical will focus on learning of these points by using two types of X-ray detector.

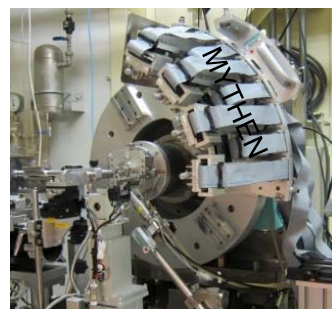
1. Before starting the practical, I will share the optical system and the powder diffractometer at BL44B2 from the aspect of total scattering experiments, as compared with overseas total scattering beamlines.

2. The practical will give you an opportunity to learn something about the preparation of powder specimens for total scattering experiments.

3. You will be able to measure total scattering data of standard powder specimens including blank capillaries by an integrating X-ray detector, imaging plate (IP).



4. Under the experimental setup similar to that with IP, the total scattering data will be taken by a photon-counting X-ray detector system composed of eight MYTHEN (DECTRIS Ltd.) modules to contrast these two detectors in the experiments.



5. Finally, I will summarize all technical points to collect high-quality total scattering data by third-generation SR sources, which lead to a better understanding on physical properties of functional materials.

[1] Egami, T. & Billinge, S. J. L. (2013). *Underneath the Bragg Peaks: Structural Analysis of Complex Materials*, 2nd ed. Amsterdam: Elsevier.