HIGH RESOLUTION POWDER DIFFRACTOMETER INSTALLED ON SPring-8

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The Large Debye-Scherrer Camera installed at BL02B2 in SPring-8 is designed for the research on accurate powder structure analysis in the area of materials science. This instrument makes it possible to collect high-angular and high-energy resolution powder data, which must contribute to increase the accuracy of structure analysis of crystalline material using powder data[1,2]. This Debye-Scherrer Camera with radius 286.5mm is available in a wide range of temperatures (20-1000K). The displex cryostat (~20K) is installed within the *w*-stage of this camera. A high temperature gas flow system can be also installed for high-temperature experiments. As a detector, it has an Imaging Plate (IP) on the *2q* arm. The pixel size of the IP can be varied from 50×50μm to 100×100μm. It is also possible to record several powder patterns (max. 20) on the same IP using a long vertical slit attached before IP. The high-energy beam with high flux allows us to collect much more Bragg reflections (high-resolution in real space imaging) with good counting statistics. The diffraction experiments are performed by transmission geometry. By using high energy X-ray photons of SPring-8, the effects of absorption become insignificant even for heavy materials involving, *e.g*., rare-earth metals. These will make it possible to measure high quality powder data of crystalline materials even at low temperature.

It should be noted that there are many levels of structural studies, for example, to measure just lattice constants, to determine space group by observing super-lattice reflections, to refine atomic distances and to obtain accurate electron densities at various temperatures. The performance of the camera was tested with standard materials, such as CeO_2, LaB_6, etc. By doing structural analyses at various levels for these standard materials, extremely high performance of the camera has been proved, particularly for accurate density studies when the data are analyzed by the combination of Rietveld refinements and the Maximum Entropy Method[1,2]. Such a high performance of the Large Debye-Scherrer Camera at BL02B2 is achieved by taking the advantage of intense, highly parallel and high-energy X-ray beams of SPring-8. This camera can play an important role to reveal the mechanism or origin of the novel function of materials, such as orbital order, mechanism of structural phase transitions and structural differences of super- and non-super conductors, if they exist.

1)M.Takata *et al., Nature* **377**,46(1995). 2) M.Takata, *et al., Z.Kristallogr.* **216**,71 (2001).