Newly developed X-ray optic: CBO-µ for micro beam XRD applications

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Switching between macro x-ray beam for conventional powder and thin film application and micro x-ray beam for micro area x-ray diffraction is a challenge as required beam specifications are largely different. The macro x-ray beam is normally one dimensionally collimated in diffraction plane and the micro beam is two dimensionally collimated to have small beam size. In conventional x-ray diffractometer, there are two ways to have the small x-ray beam either 1. Switch x-ray tube focus to point focus then combine glass capillary tube to collimate or 2. Convert the line shape macro beam to micro beam using optics. Switching the focus may cause misalignment and one may need to align the optics when it is switched. On the other hand, conversion from macro to micro beam is generally done by double pin hole collimators and it loses a lot of x-ray flux. In this paper, we will discuss newly developed optic called CBO-µ, which is consisting of multilayer mirrors to collimate one dimensionally collimated line shape macro beam to two dimensionally collimated micro beam. More than two multilayer mirrors are assembled together, and x-ray beam are propagating between the mirrors to be collimated. We have achieved approximately 10 times higher flux compared to the conventional double pin hole collimation and 10 times smaller divergence compared to poly or mono capillary optics. This optic provides highly parallel and high intense x-ray beam for micro area or beam diffraction/ scattering experiment without switching x-ray tube focus.

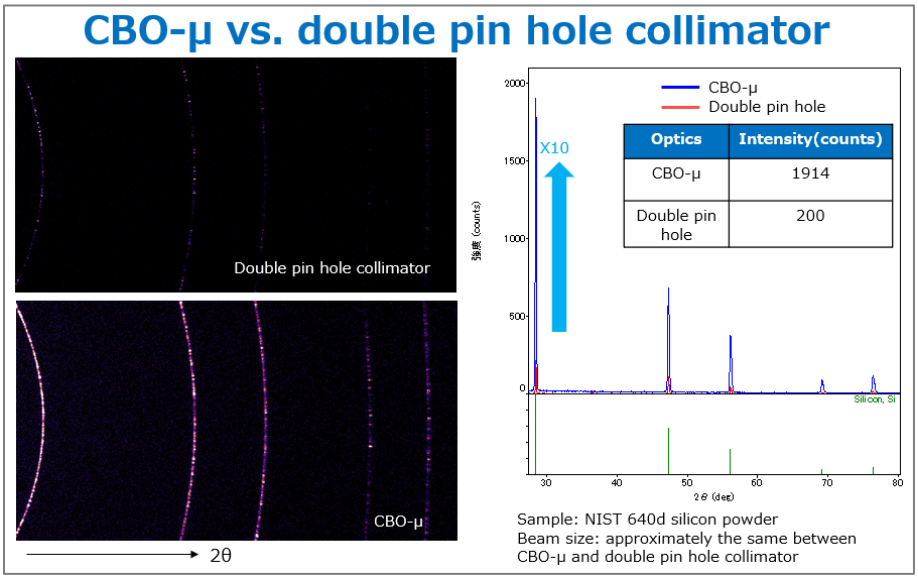

Fig. Intensity comparison between double pin hole collimator and newly developed CBO-µ optic measured on NIST 640d silicon powder in 2-D and generated 1-D profiles.