Current status of nanobeam X-ray diffraction station at SPring-8

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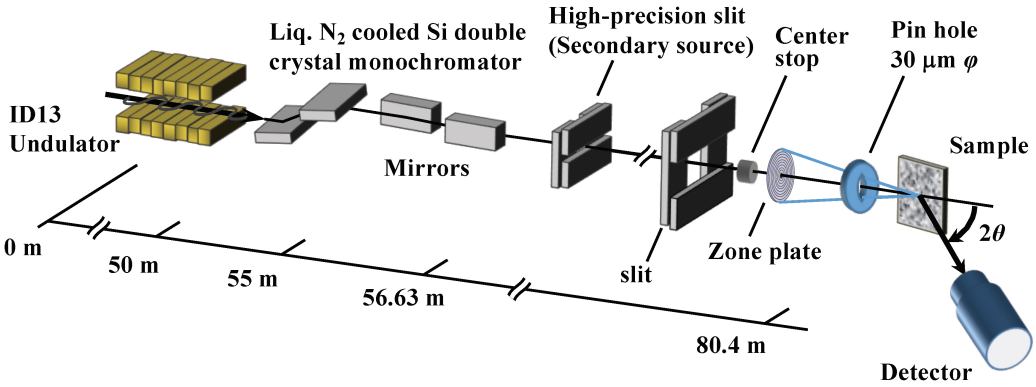
We report recent upgrades and current status of a synchrotron nano-beam X-ray diffraction (nanoXRD) station at SPring-8. The nanoXRD station is at a 4th experimental hutch of the surface and interface structure beamline BL13XU. [1] The hutch, that was constructed in March 2015, is dedicated for the nanoXRD experiments. Distance from a light source to the hutch is approximately 80 m. Temperature inside the hutch is precisely controlled by a high-precision air conditioner to reduce thermal expansions of instruments and improve positional stability.

NanoXRD technique enables non-destructive measurements of local strain and lattice tilt on surface or buried interface of semiconductor materials or devices. Reciprocal space map measurements are performed using focused X-rays with the minimum beam size around 100 nm. Figure 1 shows a schematic view of the optical setup for the nanobeam XRD system. X-rays are introduced to the 4th hutch through a vacuum pipe. Major components of the system are an ionization chamber, an attenuator unit, a slit, a micro-ionization chamber, a center stop, a zone plate (ZP), an order sorting aperture (OSA), a high-precision rotating stage for samples, a 2θ stage for detectors and a long focus microscope. An ionization chamber for monitoring the direct beam intensity and a beam monitor coupled with a CCD are mounted on a 2nd surface plate. The Slit is used to limit the horizontal beam size of the incident X-ray illuminating the ZP in order to reduce horizontal divergence of the focused X-ray and increase angular resolutions. [2] X-rays with energy range from 8 to 15 keV are focused by the ZP. The minimum beam size of 110 $\times$ 150 nm^2 is available. Compound refractive lenses made of quartz glass were also available for high energy X-rays, 25 and 30 keV. Beam size at 30 keV is 1.6 $\times$ 1.6 μm^2 and the flux is 1.2 $\times$ 10^{10} photons/s. [3] Some results and future plans are also introduced. [4, 5]



Schematic view of the optical setup for the nanobeam X-ray diffraction system at BL13XU, SPring-8.

References

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