

High speed measurement with synchrotron radiation X-ray.

*Kentaro Uesugi¹

1. Japan Synchrotron Radiation Research Institute

X-ray is suitable for a probe for investigation of materials inside because of its deep penetration depth. For examples, X-ray transmission images show the internal structure of materials, the X-ray energy spectrums show the chemical characteristics and mineral phase of the materials can be obtained from X-ray diffraction.

Synchrotron radiation X-ray has continuum spectrum and is highly collimated basically. Therefore, the X-ray condition such as energy, beam size and intensity could be tuned for the purpose of the measurement and materials. A lot of insertion devices such as in-vacuum type undulator have been installed in a storage ring of third-generation synchrotron radiation facility to obtain ultra-high flux density (photons / sec / mm²) or brilliance (photons / sec / mm² / (mrad)² / 0.1%b.w.) X-ray at the sample. The highest brilliance of X-ray is about 10⁹ time higher than the laboratory-based X-ray source. The high brilliant X-ray enable us to do ultra-high speed, spatial resolution and energy resolution measurement comparing to laboratory-based system.

At the SPring-8 the following experiments could be possible, X-ray imaging with more than 1kHz frame rate (liquid flow), X-ray diffraction with several kHz (insect flapping) and dispersive XAFS with 100Hz. These are essential technique for capturing various non-equilibrium or dynamic phenomena. At the conference, some examples of high speed measurement will be shown.

Keywords: Synchrotron radiation X-ray, High speed measurement, X-ray imaging