Time-Resolved X-Ray Reflectometry in the Multiwavelength Dispersive Geometry

Tadashi Matsushita[*a], Etsuo Arakawa[b], Tetsuo Harada[c], Tadashi Hatano[d], Yasuo Higashi[e], Yohko F. Yano[f], Yasuhiro Niwa[a], Yasuhiro Inada[g], Shusaku Nagano[h] and Takahiro Seki[h]

[a] *Photon Factory, Institute of Materials Structure Science, High Energy Accelerator Research Organization, Tsukuba, Ibaraki, Japan*

[b] *Department of Physics, Tokyo Gakugei University, Koganei, Tokyo, Japan*

[c] *LASTI, Univ. of Hyogo,Kamigoori-cho, Ako-gun, Hyogo, Japan*

[d] *Center for Advanced Microscopy and Spectroscopy, IMRAM, Tohoku University, Katahira, Aoba-ku, Sendai, Japan*

[e] *Engineering Center, High Energy Accelerator Research Organization, Tsukuba, Ibaraki, Japan*

[f] *Research Organization of Science & Engineering, Ritsumeikan University, Kusatsu-shi, Shiga, Japan*

[g] *Department of Chemistry, Ritsumeikan University, Kusatsu-shi, Shiga, Japan*

[h] *Department of Molecular Design and Engineering, Nagoya University, Chigusa-ku, Nagoya, Japan*

A new method of measuring specular X-ray reflectivity curves with a time resolutions of sub-seconds is being developed. A horizontally convergent X-ray beam having a one-to-one correlation between its direction and energy is realized when a quasi-parallel white X-ray beam is incident on a curved crystal or a laterally graded multilayer on an elliptic substrate. The X-ray beam is then incident on the surface of the specimen placed at the focus in such a way that the glancing angle in the vertical direction is the same for all X-ray components, which are reflected in the vertical direction by the surface and diverge in the horizontal plane. The perpendicular momentum transfer continuously changes as a function of the horizontal ray direction since the wavelength changes. The normalized linear intensity distribution across the beam direction measured downstream of the specimen represents the X-ray reflectivity curve. Time dependent variations of specular X-ray reflectivity curves are observed for azobenzene containing photo-responsive polymer LB films during UV irradiation and for a water surface where a globular protein is spread and then become unfolded.

Measures for realizing a millisecond time resolution will also be discussed.