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Realtime X-ray reflectometry to see changes at buried interfaces

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X-ray reflectometry is powerful in determining internal structure of multilayered thin films, such as thickness and density of each layer, as well as the roughness of surface and interfaces [1]. The measurement requires some precise angular scans near the critical angle with monochromatic parallel X-rays, and therefore it has not been thought that the technique is basically suitable to see changes. However, even without any angular scans, it is possible to obtain essentially the same data by using wide angular dispersion of the incident X-ray beam. The principle is basically known as Naudon's pioneering concept [2]. The system has been improved further by employing a monochroator, which was not used by Naudon's work. A multilayer monochromator was placed at very narrow limited space between a rotating anode X-ray source and the sample stage [3]. Use of a fast Si strip detector also contributed to improve the time-resolution. One can obtain an X-ray reflectivity curve with 4.5 decades even in 1 sec. It is possible to measure the curve down to 10-6, if 20 sec accumulation is allowed. Another advantage of the present instrument is fairly wide angular divergence, which ensures simultaneous data collection for 2 deg range. One of our recent successful applications of this method is the measurement of thermal expansion factor of the polymer thin film. It was also possible to see melting and freezing surfaces. In the presentation, such practical application will be demonstrated, in addition to the detailed description of our instruments.

[1] *K.Stoev and K.Sakurai, Spectrochim. Acta B54, 41-82 (1999).,* ***[2]*** *A. Naudon, J. Chihab, P. Goudeau and J. Mimault, J. Appl. Cryst. 22, 460 (1989）; A. Naudon, Analusis （France）, 18, I22 （1992）.,* ***[3]*** *K. Sakurai, M. Mizusawa and M. Ishii, Trans. Mater. Res. Soc. Jpn. 32, 181 （2007）; M. Mizusawa and K. Sakurai, IOP Conf. Ser.: Mater. Sci. Eng. 24, 012013 (2011).*

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