Crystallinity Estimation of Strained-Si Wafers by Using Highly Parallel X-Ray Microbeam

Yoshiyuki Tsusaka[1], Kazunori Fukuda[1], Naohiro Tomita[1], Kazuki Hayashi[1], Yasushi Kagoshima[1], Junji Matsui[1] and Atsushi Ogura[2]

[1] *Graduate School of Material Science, University of Hyogo*
3-2-1, Kouto, Kamigori, Ako, Hyogo,678-1297, Japan
[2] *School of Science and Technology, Meiji University*
1-1-1, Tama, Kawasaki, Kanagawa, 214-8571, Japan

Strained-Si (s-Si) wafers are expected as the next generation high-speed electronic devices. In order to estimate the crystallinity of s-Si wafers, we developed a high flux X-ray microbeam with a small angular divergence and a narrow energy bandwidth [1]. The X-ray microbeam is formed at SPring-8 by combining the Si single crystals and an X-ray mirror.

We estimated three commercially available s-Si wafers. The structures of these samples are s-Si/SiGe/Si, s-Si/SiGe/SiO2/Si and s-Si/SiO2/Si. The thicknesses of s-Si layers of these samples are 17.5 nm, 17.0 nm and 15.0 nm, respectively. The high flux X-ray microbeam enable us to obtain the reciprocal lattice maps of these extremely thin s-Si layers.

The intensity distributions in reciprocal lattice space maps reveal that the lattice parameters of s-Si layers are almost the same as expected values. However, the crystallographic directions normal to s-Si lattice planes greatly distribute about 500 micro radian.

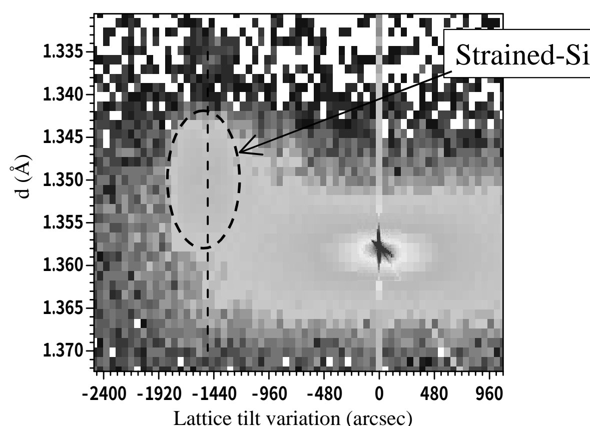

Fig.1. Reciprocal lattice map of s-Si/SiO2/Si wafer.

[1] J. Matsui et al., proceeding of the 4th international symposium on advanced science and technology of Si Materials, 2004, p237