Observations of pattern-induced strains by plain wave X-ray topography

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Micro-stripe patterns fabricated in the SiO2 interface of bonded Si (100) wafers were observed by plain wave X-ray diffraction topography. The micro-stripe patterns in the SiO2 interface induce strains for the both interface-sides of the bonded Si wafers. X-ray topographs were taken with (022) reflection (the Laue case).

Experiments and Results

X-rays were tuned to an energy of 10keV by the double-crystal monochromator at the BL24XU-C. The X-ray beam with $1\times1mm^2$ size was expanded horizontally using (115) asymmetric reflection twice by two Si (100) collimator crystals with (+,-) arrangements. Since the angle, α, between the crystal surface and diffraction plane is 16°, the asymmetric factor b was calculated to be about 1/5. Thus, the beam size was expanded horizontally 25 times and the angular divergence was reduced to 1/25. Figure 1 shows the experimental set-up at the BL24XU-C.

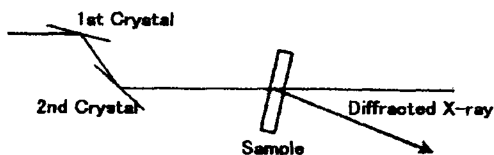

Fig.1

Micro-stripe patterns were fabricated in the SiO2 interface layer of bonded Si (100) wafers. Plain wave X-ray diffraction topography was applied to observe the pattern-induced strains of the bonded wafers. X-ray topography using (022) reflection is illustrated in Fig.2. As the bonded wafer is composed of two Si(100) wafers bonded with a little mis-orientation, topographs can be selected each one of the two related to Si(100) wafers. Perfectly bonded areas were obtained the same stress-induced topograph from the both sides of Si (100) wafers.

An example of record is shown in Photo.1. Bright sharp lines are observed if the direction of tensile-strain and the scattering vector [022] are the same.

Photo. 1.

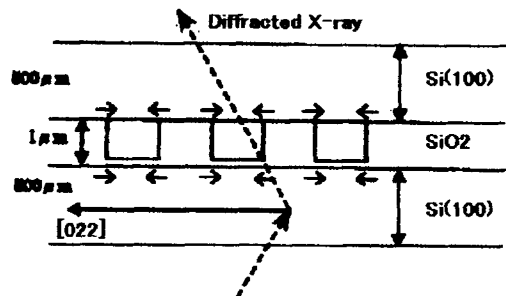

Fig.2