Domain Ordering of a Highly Strained 5 ML SrTiO$_3$ Film grown on Si(001).

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Introduction
The ability to suppress the growth of amorphous SiO$_2$ at the initial formation of ordered oxide growth on Si is tantamount to creating an ordered interface. Highly ordered and strained (-1.66%) films with a high degree of lattice matching between the SrTiO$_3$ films and Si (001) substrate were studied. The films are rotated 45° in the film plane with respect to the Si (001) substrate, (001)$_S$ // (001)$_{STO}$. (100)$_S$ // (110)$_{STO}$.

Results & Discussion
Figure 1: presents the (00L) ‘out of plane’ rod scans of both 5ML and 8ML STO films. A modeled calculation is compared with the 5ML data.

Figure 2; presents Omega scans along the [100] and [110] through the (002) STO for the 5ML film. Inset compares the [100] direction for both 5 and 8ML films.

Strong in-plane (HK) satellite features were identified around the STO Bragg reflections as shown in figure 2, where Omega scans across the STO (002) are presented. The scans shown are two different azimuthal orientations 45° apart, indicating 4-fold symmetry whereby the wings are elongated along the H$_S$ and K$_S$ to form a square. The edge length of the square shaped coherent domains measured ~1200Å. Omega scans across the STO (002) reflection for both films are presented in figure 2 inset. The 8ML system measures ~1460Å. With azimuthal rotation of the 8ML sample there is no change in the position or intensity of the satellite features, the wings are broader and of lower intensity at all angles. The satellites form a ring in the HK plane around the STO (002), were replicated by adding an identical but separate STO film vertically offset by the height of a single Si layer of 1.358Å.

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