Strain relaxation in single crystal SrTiO$_3$ grown on Si (001) MIRI
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FREESCALE SEMICONDUCTOR, TEMPE, AZ COLLABORATION — A layer of SrTiO$_3$
grown directly on Si may be used as a pseudo-substrate in perovskite deposition. As grown, SrTiO$_3$ is compressively strained, however, by subsequent annealing in oxygen at elevated temperature, a strain relieving SiO$_x$ buffer layer can be grown between the substrate and the perovskite layer. We perform a systematic study of strain relaxation in SrTiO$_3$ films grown on Si by molecular beam epitaxy as a function of the process conditions (annealing time, temperature, and oxygen partial pressure). Using a combination of X-ray diffraction, reflection high energy electron diffraction, and transmission electron microscopy we explore the oxidation and strain relaxation of SrTiO$_3$. We compare the kinetics of the buried oxide growth to that predicted by the conventional Deal-Grove model. An understanding of strain relaxation of SrTiO$_3$ on silicon can potentially be used to control the SrTiO$_3$ lattice constant for lattice matching with functional oxide overlayers.

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