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The role of strontium in oxide epitaxy on silicon (001). JAMES REINER, KEVIN GARRITY, FRED WALKER, SOHRAIB ISMAIL-BEIGI, CHARLES AHN, Yale University — The integration of crystalline oxides and semiconductors has been made possible by the development of techniques that allow crystalline SrTiO₃ to be grown on the silicon (001) surface. The most successful approach to realizing these epitaxial oxide-silicon (001) heterostructures requires manipulating substrate temperature and oxygen pressure on a layer-by-layer basis during the deposition of the metal oxide layers. The transition layer between the semiconductor and crystalline oxide is an alkaline earth metal, most often strontium, that is deposited on the silicon surface at around 650 °C. Motivated by the desire to develop a fundamental understanding of this important transition layer, we have studied the surface structures formed by strontium on miscut silicon wafers, which, unlike regular silicon wafers, have a unique surface termination. At high temperatures, this reaction rearranges the top layer of silicon to replace the original top layer with strontium. At low temperatures, this reaction is suppressed, leading to a different, but symmetry related, ordered surface structure. We find that complex oxides can be grown on either surface with comparable crystallinity.

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