Removing Native Oxide from Silicon Substrate for Perovskite Oxide Crystal Growth

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**Overview and Objective**

Most of modern electronics utilize a device called the Metal-Oxide-Silicon Field-Effect Transistor (MOSFET). The SiO\(_2\) layer in MOSFET is limited to a size of about 40 Å due to quantum tunneling as devices become increasingly smaller. This pushes the industry into complications with this fundamental limit. One solution is to reduce the SiO\(_2\) layer to about 40 Å due to quantum tunneling. As devices get increasingly smaller the SiO\(_2\) layer in MOSFET is limited to a size of about 40 Å due to quantum tunneling. As devices get increasingly smaller the SiO\(_2\) layer in MOSFET is limited to a size of about 40 Å due to quantum tunneling. As devices get increasingly smaller the SiO\(_2\) layer in MOSFET is limited to a size of about 40 Å due to quantum tunneling. As devices get increasingly smaller the SiO\(_2\) layer in MOSFET is limited to a size of about 40 Å due to quantum tunneling.

**Methods and Experiment**

The most efficient way to remove the SiO\(_2\) layer from the Si Substrate in MBE is to heat the substrate to an extremely high temperature (~980°C). Obtaining temperatures this high are not favorable for the MBE chamber used in this experiment. Strontium (Sr) can be used as a catalyst to decrease the temperature necessary to remove the oxide layer. Growing 2 ML of Sr can decrease the temperature needed to about 800°C. Determining if the oxide has been removed will be decided by RHEED images, AFM topographical images, and growth of a perovskite oxide (Strontium Titanate(SrTiO\(_3\))) on a pure Si surface.

**Analysis and Data**

Both RHEED images displayed below were taken after the Si Substrate was heated to the temperature necessary to remove the SiO\(_2\). Figure 4 (a) displays when the electron beam is along the (1 0 0) direction and Figure 4 (b) is when the electron beam is incident in the (1 1 0) direction. The arrows in Figure 4 (b) indicate a 2x pattern. This pattern is indicative of the SiO\(_2\) layer being removed. Figure 4 (c) displays a side view model of what the reconstructed clean Si surface looks like on the molecular level.

**Conclusion**

The process of heating the substrate to a very high temperature was effective in removing the SiO\(_2\) layer from the Si Substrate. The RHEED images obtained indicate that the thermal de-oxidation process was successful during growth.

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