# $SrTiO_3$ thin films on Si: Interfacial Chemistry

Beamline: X24A

Category of Researcher: PRT member

Technique: HAXPES

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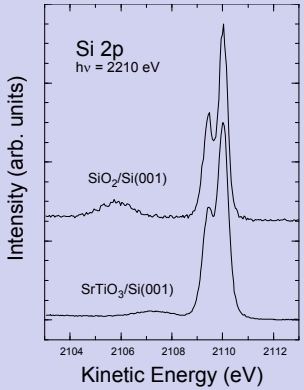
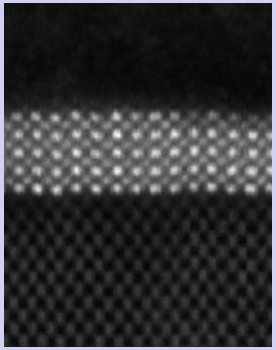
Motivation: The growth of coherent, epitaxial metal-oxide single-crystal films on Si is challenging due to the tendency of Si to oxidize when exposed to oxidants. Once the Si surface is oxidized, the crystalline template is destroyed by amorphous $SiO_2$. We have used hard x-ray photoelectron spectroscopy (HAXPES) to study films grown by Motorola using their process of kinetically controlled sequential deposition (KCSD), a process designed to limit the oxidation of the Si substrate.

Results: Si *2p* core-level HAXPES spectra demonstrate that growth by KCSD sufficiently suppresses the oxidation of the Si substrate and the formation of amorphous $SiO_2$ at the $SrTiO_3$/Si interface: The Si-O chemical shift observed at the interface is much less than that found from a thermal $SiO_2$ layer on Si. This process therefore produces coherent, single crystal $SrTiO_3$ on Si as depicted in the high-resolution TEM image.

***Motorola: 5 ML (2 nm) $SrTiO_3$ films on Si(001)***



*(Left) Si 2p core-level HAXPES spectra from a 2 nm $SrTiO_3$ film grown on Si(001) by Motorola's process of kinetically controlled sequential deposition compared to a thermal $SiO_2$ film on Si(001). Note that amorphous $SiO_2$ has not been formed at the $SrTiO_3$/Si interface, preserving the crystalline template for coherent, epitaxial growth. (Right) High resolution TEM image of the same.*