A Ferroelectric Oxide directly on Silicon

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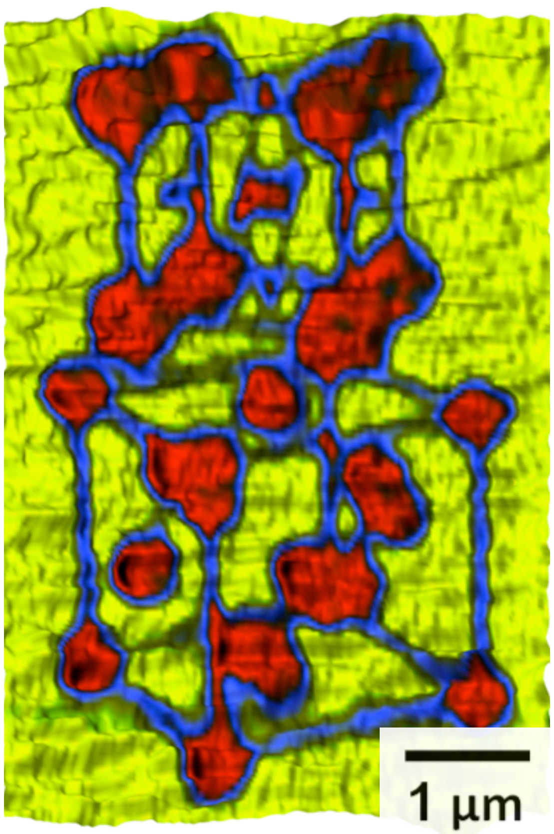

Image depicting (001) $SrTiO_3$ // (001) Si and [110] $SrTiO_3$ // [100] Si written and imaged on a 6 monolayer thick $SrTiO_3$/Si sample by piezo-force microscopy.

Silicon/silicon dioxide is arguably the most important technological interface. With the end of Moore's law scaling for silicon fast approaching, alternatives to silicon dioxide could enable new electronic device architectures. MRSEC researchers have recently achieved ferroelectric functionality in intimate contact with silicon by growing $SrTiO_3$ films in an intricate growth process using oxide molecular-beam epitaxy, producing fully strained $SrTiO_3$ layers in direct contact with silicon with no interfacial silicon dioxide. Piezo-force microscopy sees ferroelectricity in the ultra-thin $SrTiO_3$ layers. Stable ferroelectric nanodomains, observed at temperatures as high as 400 K, may form the basis of a new class of ferroelectric memories, bistable field-effect transistor devices, and low-power devices operating at room temperature.

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