Making Multifunctional Oxide Heterostructures Atom by Atom

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Abstract:

Complex oxide materials possess an enormous range of electrical, optical, and magnetic properties. For instance, insulators, high quality metals, dielectrics, ferroelectrics, piezoelectrics, semiconductors, ferromagnetics, colossal magnetoresistance materials, superconductors, and nonlinear optic materials have all been produced using oxide materials. A major challenge is the atomic layer controlled heteroepitaxial growth of various complex oxide materials so that these properties can be fully utilized in novel devices. This talk will describe the synthesis of ferroelectric, ferromagnetic, peizoelectric perovskite oxides whose structures are engineered using epitaxy. These oxide heterostructures were grown by pulsed laser deposition with in situ high pressure RHEED on an atomic-layer level and 90 degree off-axis sputtering. Numerous examples of the controlled epitaxial growth of perovskite oxides (e.g., SrRuO3, BaTiO3, Giant Piezoelectric oxide) including superlattices and metastable phases for high density non-volatile memories, active thin film piezoelectric MEMS for sensors and actuators will be described. The importance of strain and the heteroepitaxy of the perovskites directly on silicon will also be discussed.

Host: Ho Nyung Lee