Strain Effects and Magnetic Interactions Perovskite Heterostructures

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Many properties of perovskite materials (crystalline ABO_3 compounds) are significantly modified at epitaxial interfaces. Interfacial effects (strain, electronic reconstruction, and magnetic interactions) often dominate the properties of superlattices and yield behaviors not found in their constituents.

This talk will first review results for ferroelectric perovskites, showing how the effect of strain varies largely from material to material. Superlattices are used as a unique tool to identify and separate the roles of finite size and long-range coupling. We find that the long-range nature of ferroelectricity and strain results in superlattices that mimic the behavior of the corresponding alloys as the periodicity decreases. In contrast, heterostructures containing magnetic materials show interesting exchange coupling (e.g. in $(La,Sr)MnO_3/(La,Sr)FeO_3$ superlattices) or interfacially-induced ferromagnetism (in $LaMnO_3/SrTiO_3$ structures), and the superlattices show properties that are not found in the corresponding alloyed materials.

Results will be presented for heterostructures grown by pulsed-laser deposition, and analyzed by ferroelectric and transport measurements, X-ray diffraction, SQUID magnetometry, polarized neutron reflectometry, linear and circular X-ray dichroism, and transmission electron microscopy.