

# Nanodomains in Ferroelectric Superlattices

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The performance of ferroelectric devices is intimately connected with the structure and dynamics of ferroelectric domains. In ultrathin ferroelectrics, very dense domain structures can arise naturally in response to the presence of a depolarizing field and are expected to exhibit unusual static and dynamic behavior. Superlattices composed of ultrathin ferroelectric blocks sandwiched between paraelectric layers offer an ideal system for investigating the structure and functional properties of such nanodomains. Large uniform electric fields can be applied without leakage problems, while changes in the domain structure can simultaneously be observed using X-ray diffraction. Moreover, the domain structure can be tailored by exploiting Kittel's law and the electrostatic interactions between the ferroelectric layers. X-ray diffraction and transmission electron microscopy combined with electron energy loss spectroscopy were used to study the electrostatic interactions in  $\text{PbTiO}_3\text{-SrTiO}_3$  superlattices, revealing highly inhomogeneous polarization and structural profiles that arise due to the presence of ferroelectric nanodomains. A detailed characterization of the dielectric response over a broad temperature range allows the dominant role of domain wall motion to be established and quantified.