Relaxor Ferroelectric Behavior in Barium Strontium Titanate

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The development of barium strontium titanate-based tunable dielectrics is currently hindered by high losses in the paraelectric phase. Barium strontium titanate (BST) thin films and ceramics show a range of ferroelectric transition behavior, from normal, diffuse, and relaxor-like ferroelectric responses, depending on the sample preparation route. Rayleigh analysis, the temperature-dependent dielectric response, and the optical second harmonic generation were used to characterize the ferroelectric response of bulk and thin film BST. Ferroelectricity is observed to persist in BST for 30°C above the global phase transition temperature in ceramics and over 50°C in thin films. Piezoresponse force microscopy on BST ceramics with extensive residual ferroelectricity reveals the coexistence of nanoscale polar regions, typical of relaxor ferroelectrics, as well as micrometer scale domain structures. The nature of the phase transition was probed using electron energy loss spectroscopy and found to correlated with the nanoscale A-site chemical inhomogeneity in the samples.