Effect of Grain Size on Dielectric Nonlinearity in Model BaTiO(3)-Based Multilayer Ceramic Capacitors

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Source: Journal of the American Ceramic Society **Volume**: 94 **Issue**: 1 **Pages**: 58-63 DOI: 10.1111/j.1551-2916.2010.04058.x **Published**: January 2011

Abstract: First-order reversal curve (FORC) distributions as well as the ac field dependence of the dielectric permittivity were investigated for model BaTiO(3)-based multilayer ceramic capacitors in which the dielectric grain size was varied from 0.28 to 0.39 mu m. It was found that as the grain size decreased, the high-field dielectric permittivity, the peak in the irreversible FORC distribution at origin, and the reversible FORC distribution at zero bias decreased. The reversible FORC distribution of all the parts converged at high biases, indicating that the grain size dependence was influenced by domain wall contributions. Dielectric contributions from the core and shell were estimated based on the temperature dependence of the permittivity. Not unexpectedly, the relative response of the core decreased while that of the shell increased as the grain size decreased. A Preisach model using the measured FORC distribution gave a good fit to the experimental polarization-electric field loops.

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