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Ferroelectric nanocomposites: influence of nanoparticle sizes distribution on pyroelectric and electrocaloric conversion parameters

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Pyroelectric (PE) and electrocaloric (EC) properties on the ferroelectric-antiferroelectric phase boundary of ferroelectric (FE) thin films, multilayers and other low-dimensional materials can significantly differ from PE and EC properties of bulk single crystals, solid solutions and ceramics. In fact, even for FE nanoparticles, for which efficient synthesis procedures and methods for controlling polar properties have already been developed, there are still many technological problems [1] and the mysteries of theory [2]. In particular, under consideration of EC effect in BaTiO3 nanoparticle within the core–shell model [3], the depolarization effects, which are inevitable in the case of zero polarization, were completely neglected. This fact does not allows to apply the obtained in Ref. [1] results to real systems. Using phenomenological Landau-Ginsburg-Devonshire theory and the approximation of the effective medium, typical dependences of the parameters PE and EC conversion on the external electric field, temperature, and radius for spherical monodomain FE nanoparticles with fixed radius were calculated analytically in Ref. [4]. In this work typical dependences of the parameters PE and EC conversion for nanocomposites with spherical monodomain FE nanoparticles of different sizes have been calculated analytically.

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