Title

EFFECTIVE DIELECTRIC RESPONSE OF THE PEROVSKITE POLYDOMAIN STRUCTURES.

Abstract text

Effective dielectric and mechanical properties of inhomogeneous materials are important for applications and so it is very advantageous to be able to predict them for various composite structures when the bulk properties of homogeneous components are known. The inhomogeneous materials can be realized in many ways for example by random arrangements of anisotropic grains in polycrystal samples (ceramics), or, as it is in our case, by the polydomain structures of single crystals.

In this contribution we provide analysis of various polydomain structures of piezoelectric perovskite crystals. In particular, we analyze the case of tetragonal
$BaTiO_3$ with 4 domain states possessing uniaxial symmetry.
Different orientations of the spontaneous polarization in domains determine different bulk values of material constants.
For various polydomain structures constitutive equations (set of partial differential equations) are solved and the effective permittivity calculated.
While the simple enough laminar structures are solved analytically, more complicated structures (e.g. herringbone) can be treated only by appropriate numerical methods.
For this case the finite element method
(FEM) is formulated, and for testing it is compared with the exact results obtained for simple structures.

Keywords

POLYDOMAINS, EFFECTIVE PROPERTIES, FEM

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