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Accession number:20123015283153
Title:Intrinsic dielectric frequency dependent spectrum of a single domain tetragonal BaTiO<inf>3</inf>
Authors:Liu, Shuangyi (1); Huang, Limin (1); Li, Jackie (2); Obrien, Stephen (1)
Author affiliation:(1) Department of Chemistry, Energy Institute, City College of New York, New York, NY 10031, United States; (2) Department of Mechanical Engineering, City College of New York, New York, NY 10031, United States
Corresponding author:Li, J.(j.li@ccny.cuny.edu)
Source title:Journal of Applied Physics
Abbreviated source title:J Appl Phys
Volume:112
Issue:1
Issue date:July 1, 2012
Publication year:2012
Article number:014108
Language:English
ISSN:00218979
CODEN:JAPIAU
Document type:Journal article (JA)
Publisher:American Institute of Physics, 2 Huntington Quadrangle, Suite N101, Melville, NY 11747-4502, United States
Abstract:The intrinsic dielectric frequency dependent spectrum of single domain barium titanate (BaTiO<inf>3</inf>) at room temperature is investigated by considering the vibration of phonons and the conductivity of the tetragonal system in a wide frequency range up to THz. The proposed model combines Debye type of dissipation, soft mode theory, and the influence of conductivity on the dielectric loss to obtain a more precise dielectric frequency spectrum. The calculated results were compared with experimental data on single domain nanocrystals of BaTiO<inf>3</inf>, both free standing and suspended in a low dielectric medium. The comparisons provide insight into the mechanism for the dielectric behavior, which can be extended to apply to a range of composites that comprise single domain dielectrics embedded in continuous media. At the lower frequency range, conductivity plays a dominant role in the contribution to the dielectric loss along both a- and c-axes, while the phonon vibration controls the dielectric behavior of the system at higher frequency range. When the conductivity of the system increases, the dielectric loss increases below the MHz range, with such an effect diminishing when the frequency reaches the GHz regime. © 2012 American Institute of Physics.
Number of references:59
Main heading:Dielectric materials
Controlled terms:Barium titanate - Cements - Dielectric devices - Dielectric losses - Phonons
Uncontrolled terms:Batio - Continuous media - Dielectric behavior - Dielectric frequencies - Experimental data - Higher frequencies - Low dielectric - Lower frequencies - Room temperature - Single domains - Soft-mode theory - Tetragonal system - Wide frequency range
Classification code:412.1 Cement - 708.1 Dielectric Materials - 751.1 Acoustic Waves - 812.1 Ceramics

DOI:10.1063/1.4734004
Database:Compendex