

<<先进功能材料力学>>

图书基本信息

书名 : <<先进功能材料力学>>

13位ISBN编号 : 9787308100250

10位ISBN编号 : 7308100251

出版时间 : 2012-10

出版时间 : 王彪 浙江大学出版社 (2012-09出版)

作者 : 王彪

页数 : 528

版权说明 : 本站所提供之下载的PDF图书仅提供预览和简介,请支持正版图书。

更多资源请访问 : <http://www.tushu007.com>

<<先进功能材料力学>>

内容概要

This book is an attempt to tackle mainly the following two problems : (1) to analyze the effect of stress and deformation on the functional properties of the materials , and (2) to establish the quantitative models related with the microstructural evolution. The general formulation will be developed from the detailed analyses of the separated examples.

<<先进功能材料力学>>

书籍目录

1 Introduction
 2 Basic Solutions of Elastic and Electric Fields of Piezoelectric Materials with Inclusions and Defects
 2.1 The Coupled Differential Equations of Elastic and Electric Fields in Piezoelectric Solids
 2.1.1 Thermodynamic Framework
 2.1.2 Linear Constitutive Equations
 2.1.3 The Equation of Equilibrium
 2.1.4 The Basic Equations of a Static Electric Field
 2.1.5 Differential Equations for Piezoelectric Materials
 2.2 Boundary Conditions
 2.3 Solution Methods for Two-Dimensional Problems
 2.3.1 The Stroh Formalism for Piezoelectric Materials
 2.3.2 The Lekhnitskii Formalism for Piezoelectric Materials
 2.3.3 Conformal Transformation of the Core Function
 2.4 Basic Solutions for Two-Dimensional Problems
 2.4.1 Elliptical Cylindrical Inclusions in Piezoelectric Materials
 2.4.2 Cracks
 2.4.3 Dislocations and Line Charges
 2.5 Solution Methods for Three-Dimensional Problems
 2.5.1 Eigenstrains and Equivalent Inclusion Method
 2.5.2 Method of Fourier Integrals
 2.5.3 Method of Green's Function
 2.6 Basic Solution for Three-Dimensional Problems
 2.6.1 Ellipsoidal Inhomogeneous Inclusions
 2.6.2 Flat Elliptical Cracks
 2.6.3 Ellipsoidal Inhomogeneity Embedded in an Infinite Matrix when both Phases Undergo Eigenstrains
 2.6.4 Green's Function
 2.7 Remarks References
 3 Micromechanics Models of Piezoelectric and Ferroelectric Composites
 3.1 Background
 3.2 Some Definitions
 3.3 Effective Material Constants of Piezoelectric Composites
 3.3.1 The Dilute Model
 3.3.2 The Self-Consistent Model
 3.3.3 The Mori-Tanaka Mean Field Model
 3.3.4 The Differential Model
 3.4 Energy Formulation of Ferroelectric Composites
 3.4.1 Elastic Strain Energy Density for Ferroelectric Composites
 3.4.2 Intrinsic Free Energy Density for Ferroelectric Composites
 3.4.3 Total Free Energy for Ferroelectric Composites with Spherical Inclusions
 3.5 Phase Diagrams
 3.5.1 Total Free Energy for Ferroelectric Composites with Spherical Inclusions and Equiaxed Strains
 3.5.2 Phase Diagrams and Total Polarizations
 3.6 Remarks Appendix A: Radon Transform References
 4 Determination of the Smallest Sizes of Ferroelectric Nanodomains
 4.1 Introduction
 4.2 Electric Fields in Ferroelectric Thin Film
 4.2.1 General Expression of Electric Field of Ferroelectric Domain
 4.2.2 AFM-Induced Electric Field in Ferroelectric Thin Films
 4.3 Energy Expressions
 4.3.1 Energy Expression for 180° Domain in a Ferroelectric Film Covered with Top and Bottom Electrodes
 4.3.2 Energy Expression for 180° Domain in Ferroelectric Film Induced by an AFM Tip without the Top Electrode
 4.4 Driving Force and Evolution Equations of Domain Growth
 4.5 Stability Analysis
 4.6 Remarks Appendix B: Derivation of the Electric and Magnetic Field for a Growing 180° Domain
 References
 5 Size and Surface Effects of Phase Transition on Nanoferroelectric Materials
 5.1 Introduction and Overview of Ferroelectrics in Nanoscale Dimensions
 5.1.1 Ferroelectric Thin Films in Nanoscale Dimensions
 5.1.2 Ferroelectric Tunneling Junctions and Capacitors in Nanoscale Dimensions
 5.1.3 Ferroelectric Multilayers in Nanoscale
 5.1.4 Ferroelectric Nanowires and Nanotubes
 5.1.5 Ferroelectric Nanograins or Nanoislands on Substrates
 5.2 Thermodynamic Modeling and Stability Analysis of Ferroelectric Systems
 5.2.1 Background of the Thermodynamic Modeling for Ferroelectrics
 5.2.2 Electrostatics for Ferroelectrics
 5.2.3 Thermodynamics of Ferroelectrics
 5.2.4 Stability Analysis on Critical Properties of Ferroelectric Systems
 5.3 Ferroelectric Thin Films in Nanoscale
 5.3.1 Thermodynamic Model for a Thick Ferroelectric Film
 5.3.2 Size and Surface Effects on Ferroelectric Thin Films
 5.3.3 The Evolution Equation and Stability of the Stationary States
 5.3.4 Curie Temperature and Critical Thickness
 5.3.5 Curie-Weiss Law of Ferroelectric Thin Film in Nanoscale
 5.4 Critical Properties of Ferroelectric Capacitors or Tunnel Junctions
 5.4.1 The Thermodynamic Potential of the Ferroelectric Capacitors or Tunnel Junctions
 5.4.2 The Evolution Equation and Stability of the Stationary States
 5.4.3 Curie Temperature of the Ferroelectric Capacitors or Tunnel Junctions
 5.4.4 Polarization as a Function of Thickness of the Ferroelectric Capacitors or Tunnel Junctions
 5.4.5 Critical Thickness of the Ferroelectric Capacitors or Tunnel Junctions
 5.4.6 Curie-Weiss Relation of the Ferroelectric Capacitors or Tunnel Junctions
 5.5 Ferroelectric Superlattices in Nanoscale
 5.5.1 The Free Energy Functional of Ferroelectric Superlattices
 5.5.2 The Phase Transition Temperature of PTO/STO Superlattice
 5.5.3 Polarization and Critical Thickness of PTO/STO Superlattice
 5.5.4 The Curie-Weiss-Type Relation of PTO/STO Superlattice
 5.6 Ferroelectric Nanowires and Nanotubes
 5.6.1 Surface Tension of Ferroelectric Nanowires and Nanotubes
 5.6.2 Size and Surface Effects on Ferroelectric Nanowires
 5.6.3 Ferroelectric Nanotubes
 5.7 Ferroelectric Nanograins or

<<先进功能材料力学>>

Nanoislands
5.7.1 Free Energy of Ferroelectric Nanograins or Nanoislands
5.7.2 Stability of the Ferroelectric State and Transition Characteristics
5.7.3 Critical Properties of Nanograins or Nanoislands
5.8 Remarks References
Strain Engineering: Ferroelectric Films on Compliant Substrates
6.1 Background
6.2 Manipulation of Phase Transition Behavior of Ferroelectric ThinFilms on Compliant Substrates
6.2.1 Free Energy Expressions
6.2.2 Evolution Equations
6.2.3 Manipulation of Ferroelectric Transition Temperature and Critical Thickness
6.2.4 Manipulation of the Order of Transition
6.3 Piezoelectric Bending Response and Switching Behavior of Ferroelectric Thin Film with Compliant Paraelectric Substrate
6.3.1 Model of Ferroelectric Thin Film with Compliant Paraelectric Substrate and the Energy Expressions
6.3.2 Solution of the Evolution Equation
6.3.3 The Stationary and Relative Bending Displacements of the Bilayer
6.3.4 Dynamic Piezoelectric and Bending Response of the Bilayer Under a Cyclic Electric Field
6.3.5 Examples and Discussions
6.4 Critical Thickness for Dislocation Generation in Piezoelectric ThinFilms on Substrate
6.4.1 Elastic and Electric Fields in a Piezoelectric Semi-Infinite Space with a Dislocation
6.4.2 Critical Thickness for Dislocation Generation
6.4.3 Effect of Piezoelectric Behavior of the Materials on the Critical Thickness for Dislocation Formation
6.5 Critical Thickness of Dislocation Generation in Ferroelectdc Thin Film on a Compliant Substrate
6.5.1 Mechanical Properties of the Problem
6.5.2 The Formation Energy and the Critical Thickness of Spontaneous Formation of Misfit Dislocation
6.6 Remarks References
7 Derivation of the Landau-Ginzburg Expansion Coefficients
7.1 Introduction
7.2 Fundamental of the Landau-Devonshire Theory
7.2.1 The History of the Landau Free Energy Theory
7.2.2 The Thermodynamic Functions of the Dielectrics and Phase Transition
7.2.3 The Expansion of the Free Energy and Phase Transition
7.3 Determination of Landau Free Energy Expansion Coefficients Based on Experimental Methods
7.3.1 The Experimental Observation of the Phase Transition Characteristics in Ferroelectrics
7.3.2 The Phenomenological Treatment of Devonshire Theory
7.3.3 The Elastic Gibbs Free Energy of PbTiO₃ and Its Coefficients
7.3.4 The Determination of the Expansion Coefficients from the First-Principle Calculation Based on the Effective Hamiltonian Method
7.4 Gradient Terms in the Landau-Devonshire-Ginzburg Free Energy Expansion
7.4.1 The Consideration of Spatial Non-uniform Distribution of the Order Parameters in the Landau Theory
7.4.2 The Critical Region and the Applicability of Landau Mean Field Theory
7.4.3 Determination of the Gradient Terms from the Lattice Dynamic Theory
7.4.4 The Extrapolation Length and the Gradient Coefficient
7.5 The Transverse Ising Model and Statistical Mechanics Approaches
7.5.1 Phase Transition from the Transverse Ising Model
7.5.2 Relationship of the Parameters Between Landau Theory and the Transverse Ising Model
7.5.3 Determination of Landau-Ginzburg Free Energy Expansion Coefficients from Statistical Mechanics
7.6 Remarks References
8 Multiferroic Materials
8.1 Background
8.2 Coupling Mechanism of Multiferroic Materials
8.2.1 Single Phase Multiferroic Materials
8.2.2 Magnetoelectric Composites
8.3 Theories of Magnetoelectric Coupling Effect at Low Frequency
8.3.1 Energy Formulation for Multiferroic Composites
8.3.2 Phase Transition Behaviors in Layered Structures
8.3.3 Magnetoelectric Coupling Coefficients in Layered Structures
8.4 Magnetoelectric Coupling at Resonance Frequency
8.4.1 Magnetoelectric Coupling at Bending Modes
8.4.2 Magnetoelectric Coupling at Electromechanical Resonance
8.4.3 Magnetoelectric Coupling at Ferromagnetic Resonance
8.5 Remarks References
9 Dielectric Breakdown of Mieroeltronie and Nanoeletronie Devices
9.1 Introduction
9.2 Basic Concepts
9.2.1 MOS Structure
9.2.2 Different Tunneling Modes
9.2.3 Dielectric Breakdown Modes
9.2.4 Defect Generation
9.2.5 Basic Statistical Concepts of Dielectric Breakdown
9.2.6 Stress Induced Leakage Current
9.2.7 Holes Generation
9.2.8 Energetics of Defects
9.3 Mechanism Analysis of Tunneling Phenomena in Thin Oxide Film
9.3.1 Self-consistent Schrödinger's and Poisson's Equations
9.3.2 Transmission Coefficient
9.3.3 Tunneling Current Components
9.3.4 Microscopic Investigation of Defects from First-Principles Calculation
9.3.5 Manipulating Tunneling by Applied Strains
9.4 Degradation Models in Gate Oxide Films
9.4.1 Anode Hole Injection Model
9.4.2 Thermochemical Model
9.4.3 Anode Hydrogen Release Model
9.4.4 Thermal Breakdown Model
9.4.5 Mechanical-Stress-Induced Breakdown Model
9.4.6 Remarks
9.5 Statistical Models of Dielectric Breakdown
9.5.1 A Basic Statistical Model
9.5.2 A Three-Dimensional Statistical Model
9.5.3 Sphere and Cube Based Percolation Models
9.5.4 Combination of Percolation Model and Degradation Model
9.6 Damage of Dielectric Breakdown in MOSFET
9.6.1 Lateral Propagation of Breakdown

<<先进功能材料力学>>

Spot9.6.2 Dielectric Breakdown-Induced Epitaxy9.6.3 Dielectric Breakdown-Induced Migration9.6.4 Meltdown and Regrowth of Silicided Poly-Si Gate9.6.5 Damage in Substrate9.7 RemarksReferencesIndex

<<先进功能材料力学>>

编辑推荐

《先进功能材料力学(英文版)》编辑推荐：近些年来，压电、铁电、光电等功能材料由于制备方法和工艺的进步以及越来越广泛的工程应用已经成为材料科学，凝聚态物理，力学等领域的研究热点。这些功能材料传统上不是力学领域的研究课题。

但由于现代的材料加工工艺必然导致不可忽略的应力和应变，而且，人们也发现由于应变应力的存在，功能材料的性能会发生很大的改变。

这样，力学与电、磁、光等功能的耦合成为目前热门的研究领域。

而且，任何的功能材料都存在强度和可靠性的问题，这也需要拓宽传统的力学模型和理论进行解决。

《先进功能材料力学(英文版)》的重点是针对力、电、磁、光的重要耦合问题，发展新颖的数学模型进行解释、预报先进功能材料的性能。

研究利用力学变量定量调控功能材料性能的理论和方法。

将系统总结作者多年来在压电、铁电和光电等功能材料与力学相互作用等方面的研究成果，初步形成功能材料的力学模型理论体系。

《先进功能材料力学(英文版)》重点强调交叉学科和非线性科学的作用，从工程实际问题出来，系统描述物理建模和求解的方法。

《先进功能材料力学(英文版)》可以作为相关学科的研究生和研究人员的主要参考书。

<<先进功能材料力学>>

版权说明

本站所提供下载的PDF图书仅提供预览和简介，请支持正版图书。

更多资源请访问:<http://www.tushu007.com>