

1. Record Nr.	UNINA9910877449703321
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Titolo	Mechanical properties of ceramics / / John B. Wachtman
Pubbl/distr/stampa	Hoboken, N.J., : Wiley, c2009
ISBN	9786612279959 9781523115532 152311553X 9781282279957 1282279955 9780470451519 0470451513 9780470451502 0470451505
Edizione	[2nd ed. /]
Descrizione fisica	1 online resource (497 p.)
Classificazione	UQ 8500 ZM 6100
Altri autori (Persone)	CannonW. Roger MatthewsonM. John
Disciplina	620.1/40492 620.140492
Soggetti	Ceramic materials - Mechanical properties Ceramic materials - Electric properties
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	MECHANICAL PROPERTIES OF CERAMICS; CONTENTS; Preface; Acknowledgments; 1 Stress and Strain; 1.1 Introduction; 1.2 Tensor Notation for Stress; 1.3 Stress in Rotated Coordinate System; 1.4 Principal Stress; 1.4.1 Principal Stresses in Three Dimensions; 1.5 Stress Invariants; 1.6 Stress Deviator; 1.7 Strain; 1.8 True Stress and True Strain; 1.8.1 True Strain; 1.8.2 True Stress; Problems; 2 Types of Mechanical Behavior; 2.1 Introduction; 2.2 Elasticity and Brittle Fracture; 2.3 Permanent Deformation; 3 Elasticity; 3.1 Introduction; 3.2 Elasticity of Isotropic Bodies 3.3 Reduced Notation for Stresses, Strains, and Elastic Constants 3.4 Effect of Symmetry on Elastic Constants; 3.5 Orientation Dependence of

Elastic Moduli in Single Crystals and Composites; 3.6 Values of Polycrystalline Moduli in Terms of Single-Crystal Constants; 3.7 Variation of Elastic Constants with Lattice Parameter; 3.8 Variation of Elastic Constants with Temperature; 3.9 Elastic Properties of Porous Ceramics; 3.10 Stored Elastic Energy; Problems; 4 Strength of Defect-Free Solids; 4.1 Introduction; 4.2 Theoretical Strength in Tension; 4.3 Theoretical Strength in Shear; Problems
5 Linear Elastic Fracture Mechanics 5.1 Introduction; 5.2 Stress Concentrations; 5.3 Griffith Theory of Fracture of a Brittle Solid; 5.4 Stress at Crack Tip: An Estimate; 5.5 Crack Shape in Brittle Solids; 5.6 Irwin Formulation of Fracture Mechanics: Stress Intensity Factor; 5.7 Irwin Formulation of Fracture Mechanics: Energy Release Rate; 5.7.1 Relationship between G and $K(I)$; 5.8 Some Useful Stress Intensity Factors; 5.9 The J Integral; 5.10 Cracks with Internal Loading; 5.11 Failure under Multiaxial Stress; Problems; 6 Measurements of Elasticity, Strength, and Fracture Toughness
6.1 Introduction; 6.2 Tensile Tests; 6.3 Flexure Tests; 6.3.1 Three-Point Bending; 6.3.2 Four-Point Bending; 6.3.3 Fracture Toughness Measurement by Bending; 6.4 Double-Cantilever-Beam Test; 6.5 Double-Torsion Test; 6.6 Indentation Test; 6.6.1 Direct Method; 6.6.2 Indirect Method; 6.6.3 Modified Method; 6.6.4 Summary of the Three Methods; 6.6.5 ASTM Standard C 1421 Method; 6.7 Biaxial Flexure Testing; 6.8 Elastic Constant Determination Using Vibrational and Ultrasonic Methods; Problems; 7 Statistical Treatment of Strength; 7.1 Introduction; 7.2 Statistical Distributions
7.3 Strength Distribution Functions 7.3.1 Gaussian, or Normal, Distribution; 7.3.2 Weibull Distribution; 7.3.3 Comparison of the Normal and Weibull Distributions; 7.4 Weakest Link Theory; 7.5 Determining Weibull Parameters; 7.6 Effect of Specimen Size; 7.7 Adaptation to Bend Testing; 7.8 Safety Factors; 7.9 Example of Safe Stress Calculation; 7.10 Proof Testing; 7.11 Use of Pooled Fracture Data in Linear Regression Determination of Weibull Parameters; 7.12 Method of Maximum Likelihood in Weibull Parameter Estimation; 7.13 Statistics of Failure under Multiaxial Stress
7.14 Effects of Slow Crack Propagation and R-Curve Behavior on Statistical Distributions of Strength

Sommario/riassunto

A Comprehensive and Self-Contained Treatment of the Theory and Practical Applications of Ceramic Materials When failure occurs in ceramic materials, it is often catastrophic, instantaneous, and total. Now in its Second Edition, this important book arms readers with a thorough and accurate understanding of the causes of these failures and how to design ceramics for failure avoidance. It systematically covers: Stress and strain Types of mechanical behavior Strength of defect-free solids Linear elastic fracture mechanics Measurements of elasticity, stren
