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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