

Table of contents

- **Preface** (p. ix)
- **Acknowledgments** (p. xii)
- **1 Introduction** (p. 1)
- **1.1 Coatings and thin films** (p. 2)
- **1.2 Bulk parts** (p. 5)
- **1.3 Other nanostructured materials for structural applications** (p. 8)
- **1.4 Topics to be covered** (p. 21)
- **References** (p. 21)
- **2 Processing of structural nanocrystalline materials** (p. 25)
- **2.1 Introduction** (p. 25)
- **2.2 Methods for preparation of bulk structural nanocrystalline materials** (p. 27)
- **2.3 Preparation of nanostructured, hard, and superhard coatings** (p. 72)
- **References** (p. 85)
- **3 Stability of structural nanocrystalline materials - grain growth** (p. 93)
- **3.1 Introduction** (p. 93)
- **3.2 Experimental methods for measuring grain growth** (p. 94)
- **3.3 Grain-growth theories for conventional grain size materials** (p. 99)
- **3.4 Grain growth at ambient temperature in nanocrystalline materials** (p. 108)
- **3.5 Inhibition of grain growth in nanocrystalline materials** (p. 109)
- **3.6 Experimental studies of isothermal grain-growth kinetics in nanocrystalline materials** (p. 114)
- **3.7 Thin films and coatings** (p. 118)
- **References** (p. 128)
- **4 Mechanical properties of structural nanocrystalline materials - experimental observations** (p. 134)
- **4.1 Elastic properties of nanostructured materials** (p. 134)
- **4.2 Anelastic properties** (p. 136)
- **4.3 Hardness and strength** (p. 138)
- **4.4 Ductility of nanocrystalline materials: optimization of strength and ductility** (p. 151)
- **4.5 Superplasticity of nanocrystalline materials** (p. 169)
- **4.6 Creep of nanocrystalline materials** (p. 173)
- **4.7 Fatigue of nanocrystalline materials** (p. 177)
- **4.8 Fracture and fracture toughness of nanocrystalline materials** (p. 180)
- **4.9 Mechanical properties of superhard nanostructured coatings** (p. 182)
- **4.10 Summary** (p. 194)
- **References** (p. 196)
- **5 Mechanical properties of structural nanocrystalline materials - theory and simulations** (p. 204)
- **5.1 Introduction** (p. 204)
- **5.2 Specific structural features of nanocrystalline materials** (p. 208)

- **5.3 Basic concepts on plastic deformation processes in nanocrystalline materials** (p. 217)
- **5.4 Nanoscale and interface effects on lattice dislocation slip** (p. 221)
- **5.5 Deformation modes associated with enhanced diffusion along grain boundaries and their triple junctions. Competition between deformation mechanisms. Effect of a distribution of grain size** (p. 224)
- **5.6 Grain-boundary sliding in nanocrystalline materials** (p. 229)
- **5.7 Interaction between deformation modes in nanocrystalline materials. Emission of lattice dislocations from grain boundaries. Twin deformation mode** (p. 245)
- **5.8 Interaction between deformation modes in nanocrystalline materials. Rotational deformation mode** (p. 258)
- **5.9 Fracture mechanisms in nanocrystalline materials. Generation, growth and convergence of nanocracks** (p. 268)
- **5.10 Strain-rate sensitivity, ductility and superplasticity of nanocrystalline materials** (p. 291)
- **5.11 Diffusion in nanocrystalline materials** (p. 303)
- **5.12 Concluding remarks** (p. 306)
- **References** (p. 308)
- **6 Corrosion of structural nanomaterials** (p. 317)
- **6.1 Introduction** (p. 317)
- **6.2 Effect of defects and grain size** (p. 318)
- **6.3 Corrosion of metallic and alloyed nanostructured materials** (p. 319)
- **6.4 Nanocrystalline nickel** (p. 319)
- **6.5 Nanocrystalline cobalt and its alloys** (p. 320)
- **6.6 Zirconium and its alloys** (p. 326)
- **6.7 304 Austenitic steels: wet corrosion** (p. 331)
- **6.8 304 Austenitic steels: dry corrosion** (p. 333)
- **6.9 Magnetic nanocomposites** (p. 336)
- **References** (p. 338)
- **7 Applications of structural nanomaterials** (p. 341)
- **7.1 Introduction** (p. 341)
- **7.2 Ceramic nanocomposites for load-bearing applications** (p. 343)
- **7.3 Bulk nanoribbons can tie up photonic circuits** (p. 343)
- **7.4 Functionally gradient nanoparticles** (p. 344)
- **7.5 Nanotechnology in automotive applications** (p. 344)
- **7.6 Nanoclay-polymer composites for structural applications** (p. 346)
- **7.7 Nanotechnology in the consumer world** (p. 347)
- **7.8 Nanobelts for actuator applications** (p. 350)
- **7.9 Nanosteel for high wear, toughness and hardness applications** (p. 350)
- **7.10 Copper-carbon nanotube composite for high heat applications** (p. 351)
- **7.11 Metal matrix nanocomposites for structural applications** (p. 352)
- **7.12 Application of ferrofluids with magnetic nanoparticles** (p. 352)
- **7.13 Industrial applications of nanocomposite coatings** (p. 355)
- **7.14 Applications of electrodeposited nanostructures** (p. 358)
- **7.15 Potential military applications** (p. 359)

- **7.16 Concluding remarks** (p. 360)
- **References** (p. 360)
- **Index** (p. 362)