

Fundamentals of MICROFABRICATION AND NANOTECHNOLOGY

VOLUME I



Solid-State Physics, Fluidics, and Analytical Techniques in Micro- and Nanotechnology

Covers All Aspects of the Solid-State Physics Behind Nanotechnology

Providing a clear theoretical understanding of MEMS and NEMS, *Solid-State Physics, Fluidics, and Analytical Techniques in Micro- and Nanotechnology* focuses on nanotechnology and the science behind it, including solid-state physics. It provides a clear understanding of the electronic, mechanical, and optical properties of solids relied on in integrated circuits (ICs), MEMS, and NEMS. After exploring the rise of Si, MEMS, and NEMS in a historical context, the text discusses crystallography, quantum mechanics, the band theory of solids, and the silicon single crystal. It concludes with coverage of photonics, the quantum hall effect, and superconductivity. Fully illustrated in color, the text offers end-of-chapter problems, worked examples, extensive references, and a comprehensive glossary of terms.

Topics include:

- Crystallography and the crystalline materials used in many semiconductor devices
- Quantum mechanics, the band theory of solids, and the relevance of quantum mechanics in the context of ICs and NEMS
- Single crystal Si properties that conspire to make Si so important
- Optical properties of bulk 3D metals, insulators, and semiconductors
- Effects of electron and photon confinement in lower dimensional structures
- How evanescent fields on metal surfaces enable the guiding of light below the diffraction limit in plasmonics
- Metamaterials and how they could make for perfect lenses, changing the photonic field forever
- Fluidic propulsion mechanisms and the influence of miniaturization on fluid behavior
- Electromechanical and optical analytical processes in miniaturized components and systems

The first volume in *Fundamentals of Microfabrication and Nanotechnology, Third Edition, Three-Volume Set*, the book presents the electronic, mechanical, and optical properties of solids that are used in integrated circuits, MEMS, and NEMS and covers quantum mechanics, electrochemistry, fluidics, and photonics. It lays the foundation for a qualitative and quantitative theoretical understanding of MEMS and NEMS.

Other volumes in *Fundamentals of Microfabrication and Nanotechnology, Third Edition, Three-Volume Set* include:

Manufacturing Techniques for Microfabrication and Nanotechnology

From MEMS to Bio-MEMS and Bio-NEMS: Manufacturing Techniques and Applications