

Ahmad Safari
E. Koray Akdoğan
Editors

Piezoelectric and Acoustic Materials for Transducer Applications



Springer

Contents

Preface	v
Part I Fundamentals of Piezoelectricity	
1 Thermodynamics of Ferroelectricity	3
E. Koray Akdoğan and Ahmad Safari	
2 Piezoelectricity and Crystal Symmetry	17
A.L. Kholkin, N.A. Pertsev, and A.V. Goltsev	
3 Crystal Chemistry of Piezoelectric Materials	39
Susan Trolier-McKinstry	
Part II Piezoelectric and Acoustic Materials for Transducer Technology	
4 Lead-Based Piezoelectric Materials	59
Dragan Damjanovic	
5 KNN-Based Piezoelectric Ceramics	81
Marija Kosec, Barbara Malič, Andreja Benčan, and Tadej Rojac	
6 Bismuth-based Piezoelectric Ceramics	103
Tadashi Takenaka	
7 Electropolymers for Mechatronics and Artificial Muscles	131
Zhongyang Cheng, Qiming Zhang, Ji Su, and Mario El Tahchi	
8 Low-Attenuation Acoustic Silicone Lens for Medical Ultrasonic Array Probes	161
Y. Yamashita, Y. Hosono, and K. Itsumi	
9 Carbon-Fiber Composite Materials for Medical Transducers	179
Toshio Kondo	

Part III Transducer Design and Principles

- 10 Piezoelectric Transducer Design for Medical Diagnosis and NDE . . . 191**
Marc Lethiecq, Franck Levassort, Dominique Certon,
and Louis Pascal Tran-Huu-Hue
- 11 Piezoelectric Transducer Designs for Sonar Applications 217**
James F. Tressler
- 12 Finite Element Analysis of Piezoelectric Transducers 241**
Anne-Christine Hladky-Hennion and Bertrand Dubus

Part IV Piezoelectric Transducer Fabrication Methods

- 13 Piezoelectric Fiber Composite Fabrication 261**
Andreas Schönecker
- 14 Composition Gradient Actuators 289**
Ralf Steinhausen and Horst Beige
- 15 Robocasting of Three-Dimensional Piezoelectric Structures 305**
James E. Smay, Bruce Tuttle, and Joseph Cesarano III
- 16 Micropositioning 319**
J. Juuti, M. Leinonen, and H. Jantunen
- 17 Piezoelectric Actuator Designs 341**
Aydin Doğan and Erman Uzgur
- 18 Piezoelectric Energy Harvesting using Bulk Transducers 373**
Shashank Priya, Rachit Taneja, Robert Myers, and Rashed Islam
- 19 Piezocomposite Ultrasonic Transducers for High-Frequency Wire
Bonding of Semiconductor Packages 389**
Siu Wing Or and Helen Lai Wa Chan
- 20 Piezoelectric MEMS: Materials and Devices 413**
Nazanin Bassiri-Gharb
- 21 High-Frequency Ultrasonic Transducers and Arrays 431**
K. Kirk Shung, Jonathan M. Cannata, and Qifa Zhou
- 22 Micromachined Ultrasonic Transducers 453**
Massimo Pappalardo, Giosue Caliano, Alessandro S. Savoia,
and Alessandro Caronti

- Index 479**