Soft Actuators

Kinji Asaka • Hidenori Okuzaki
Editors

Soft Actuators

Materials, Modeling, Applications,
and Future Perspectives

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Preface

A variety of soft actuators has so far been developed not only from the fundamental viewpoint of basic material science, chemistry, physics, and biology but also from the engineering viewpoint for the practical applications to light-weight, low-cost, no-noise, less-pollution, and high-efficiency micro- and macro-artificial muscles and soft robotic systems. This book “Soft Actuators: Materials, Modeling, Applications, and Future Perspectives” reviews current and comprehensive research and development of soft actuators, and encompasses interdisciplinary studies of materials science and chemistry, mechanics, electronics, robotics, and bioscience. The topics of this book update the preceding book (in Japanese) entitled “Soft Actuators which Drive Future Technologies -Recent R&D Activities Focused on Polymers and Biomaterials-” edited by Prof. Yoshihito Osada (Riken) and Prof. Takahisa Taguchi (AIST) published by CMC Publishing Co., Ltd. in 2010.

Chapters 1 and 2 of this book provide an overview of the current status of materials, properties, applications, and market of soft actuators, including background and history of soft actuators with typical references as milestones of the progress. Chapters 3–5 describe thermo-driven soft actuators using temperature-responsive gels and nanofibers. Electro-driven soft actuators, which are also known as electro-active polymer (EAP) actuators, utilizing ionic and electric conductive polymers, carbon nanotubes, ionic liquid gels, dielectric elastomers and gels, and piezoelectric polymers were intensively discussed in Chaps. 6–15. On the other hand, light-driven soft actuators based on photochromism, photoisomerization, and photoredox reaction were described in Chaps. 16–18, while Chaps. 19 and 20 cover the topics on magneto-driven actuators, both of which enable operation of soft actuators by remote control. Furthermore, various motion models and control methods of soft actuators were examined in Chaps. 21–26, which are crucially important for the practical applications to Braille displays, soft micro-robots for medical applications, micro-pumps, and transducers evaluated in Chaps. 27–32. Finally, Chaps. 33–35 focus on next-generation bio-actuators based on biomaterials to provide future perspectives for artificial muscle technology of bio-nanomachines.

These topics covered in this book not only promote further research and development of soft actuators, but also lead the way to their utilization and industrialization. Readers can obtain detailed, useful information about materials, methods of synthesis, fabrication, and measurements. The new ideas offered in this book will provide inspiration and encouragement to researchers and developers as they explore new fields of applications for soft actuators.

Osaka, Japan
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Contents

Part I Introduction

- 1 Progress and Current Status of Materials and Properties of Soft Actuators** 3
Hidenori Okuzaki
- 2 Current Status of Applications and Markets of Soft Actuators** 19
Kinji Asaka and Kayo Nakamura

Part II Materials of Soft Actuators: Thermo-Driven Soft Actuators

- 3 Electromagnetic Heating** 33
Takeshi Yamauchi
- 4 Thermo-Responsive Nanofiber Mats Fabricated by Electrospinning** 43
Hidenori Okuzaki
- 5 Self-Oscillating Gels** 55
Ryo Yoshida

Part III Materials of Soft Actuators: Electro-Driven Soft Actuators

- 6 Ionic Conductive Polymers** 81
Kunitomo Kikuchi and Shigeki Tsuchitani
- 7 Conducting Polymers** 95
Keiichi Kaneto

8 Humidity-Sensitive Conducting Polymer Actuators	111
Hidenori Okuzaki	
9 Carbon Nanotube/Ionic Liquid Composites	127
Takushi Sugino, Kenji Kiyohara, and Kinji Asaka	
10 Ion Gels for Ionic Polymer Actuators	141
Masayoshi Watanabe, Satoru Imaizumi, Tomohiro Yasuda, and Hisashi Kokubo	
11 Ionic Liquid/Polyurethane/PEDOT:PSS Composite Actuators	157
Hidenori Okuzaki	
12 Dielectric Gels	169
Toshihiro Hirai	
13 Dielectric Elastomers	183
Seiki Chiba	
14 Development of Actuators Using Slide Ring Materials and Their Various Applications	197
Hiromitsu Takeuchi	
15 Piezoelectric Polymers	203
Yoshiro Tajitsu	
 Part IV Materials of Soft Actuators: Light-Driven Soft Actuators	
16 Spiropyran-Functionalized Hydrogels	219
Kimio Sumaru, Toshiyuki Takagi, Shinji Sugiura, and Toshiyuki Kanamori	
17 Photomechanical Energy Conversion with Cross-linked Liquid-Crystalline Polymers	231
Jun-ichi Mamiya	
18 Photoredox Reaction	245
Tetsu Tatsuma	
 Part V Materials of Soft Actuators: Magneto-Driven Soft Actuators	
19 Magnetic Fluid Composite Gels	255
Toshihiro Hirai	
20 Magnetic Particle Composite Gels	271
Tetsu Mitsumata	

Part VI Modeling

- 21 Molecular Mechanism of Electrically Induced Volume Change of Porous Electrodes** 287
Kenji Kiyohara, Takushi Sugino, and Kinji Asaka
- 22 Material Modeling** 299
Yutaka Toi
- 23 Distributed Parameter System Modeling** 313
Kentaro Takagi, Gou Nishida, Bernhard Maschke,
and Kinji Asaka
- 24 Modeling and Feedback Control of Electro-Active Polymer Actuators** 327
Norihiko Kamamichi, Kentaro Takagi, and Shigenori Sano
- 25 Motion Design-A Gel Robot Approach** 343
Mihoko Otake
- 26 Motion Control** 355
Minoru Hashimoto

Part VII Applications

- 27 Application of Nano-Carbon Actuator to Braille Display** 371
Isao Takahashi, Tomomasa Takatsuka, and Munemitsu Abe
- 28 Underwater Soft Robots** 385
Kentaro Takagi, Zhi-Wei Luo, and Kinji Asaka
- 29 IPMC Actuator-Based Multifunctional Underwater Microrobots** 401
Shuxiang Guo and Liwei Shi
- 30 Medical Applications** 423
Tadashi Ihara
- 31 Micro Pump Driven by a Pair of Conducting Polymer Soft Actuators** 435
Masaki Fuchiwaki
- 32 Elastomer Transducers** 447
Mikio Waki and Seiki Chiba

Part VIII Next-Generation Bio-Actuators

- 33 Tissue Engineering Approach to Making Soft Actuators** 463
Toshia Fujisato, Shunya Takagi, Tomohiro Nakamura,
and Hiroshi Tsutsui

34	ATP-Driven Bio-machine	475
	Daisuke Inoue, Arif Md. Rashedul Kabir, Kazuki Sada, Jian Ping Gong, and Akira Kakugo	
35	Employing Cytoskeletal Treadmilling in Bio-Actuator	489
	Ken-Ichi Sano, Ryuzo Kawamura, and Yoshihito Osada	
	Index	499