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Electroactive Polymers (EAP)

Editors: Q. M. Zhang, Takeo Furukawa, Yoseph Bar-Cohen and J. Scheinbeim

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Electroactive Polymers (EAP)

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CONTENTS

Preface xi

Acknowledgments xiii

Materials Research Society Symposium Proceedings xiv

APPLICATIONS

***Compliant Actuators Based on Electroactive Polymers** 3
S.G. Wax, R.R. Sands, and L.J. Buckley

**Challenges to the Transition to the Practical Application of
IPMC as Artificial-Muscle Actuators** 13
Y. Bar-Cohen, S. Leary, A. Yavrouian, K. Oguro, S. Tadokoro,
J. Harrison, J. Smith, and J. Su

FERROELECTRIC POLYMERS

***Structure, Properties, and Applications of Single Crystalline
Films of Vinylidene Fluoride and Trifluoroethylene Copolymers** 23
H. Ohigashi

***Structural Change in Ferroelectric Phase Transition of
Vinylidene Fluoride Copolymers as Studied by WAXS, SAXS,
IR, Raman, and Computer Simulation Techniques** 35
K. Tashiro

**Effects of Sample Processing and High-Energy Electron Irradiation
Conditions on the Structural and Transitional Properties of
P(VDF-TrFE) Copolymer Films** 47
Vivek Bharti, Z-Y. Cheng, H.S. Xu, G. Shanthi, T-B. Xu,
T. Mai, and Q.M. Zhang

Synthesis and Electric Property of VDF/TrFE/HFP Terpolymers 53
A. Petchsuk and T.C. Chung

*Invited Paper

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Electroactive Polymers (EAP)
Editors: Q. M. Zhang, Takeo Furukawa, Yoseph Bar-Cohen and J. Scheinbeim
Frontmatter
[More information](#)

***Giant Electrostrictive Response in Poly(vinylidene-fluoride hexafluoropropylene) copolymer 61**
Xiaoyan Lu, Adriana Schirokauer, and Jerry Scheinbeim

Electro-Mechanical Properties of Electron Irradiated P(VDF-TrFE) Copolymers Under Different Mechanical Stresses 71
Z-Y. Cheng, S.J. Gross, V. Bharti, T-B. Xu, T. Mai, and Q.M. Zhang

Electron Irradiated P(VDF-TrFE) Copolymers for Use in Naval Transducer Applications 77
T. Ramotowski, K. Hamilton, G. Kavarnos, Q. Zhang, and V. Bharti

Dynamics of Pyroelectricity of a Copolymer of Vinylidene Fluoride With Trifluoroethylene 83
Y. Takahashi, J. Taniwaki, and T. Furukawa

Analysis of Ferroelectric Switching Process in VDF/TrFE Copolymers 89
Kenji Kano, Hidekazu Kodama, Yoshiyuki Takahashi, and Takeo Furukawa

Ferroelectric and Piezoelectric Properties of Blends of Poly(vinylidene fluoride-trifluoroethylene) and a Graft Elastomer 95
J. Su, Z. Ounaies, and J.S. Harrison

Structural and Electronic Characterization of Epitaxially-Grown Ferroelectric Vinylidene Fluoride Oligomer Thin Films 101
K. Ishida, K. Noda, A. Kubono, T. Horiuchi, H. Yamada, and K. Matsushige

Non-Electrical Poling in Novel Ferroelectric Polymers 107
S. Tasaka, O. Furutani, and N. Inagaki

***PIEZOELECTRIC, ELECTROSTRICTIVE, AND
DIELECTRIC ELASTOMER***

***Ultra-High Strain Response of Elastomeric Polymer Dielectrics 119**
Roy Kornbluh, Ronald Pelrine, Jose Joseph, Qibing Pei, and Seiki Chiba

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978-1-107-41326-9 - Materials Research Society Symposium Proceedings: Volume 600:

Electroactive Polymers (EAP)

Editors: Q. M. Zhang, Takeo Furukawa, Yoseph Bar-Cohen and J. Scheinbeim

Frontmatter

[More information](#)

Electrostrictive Graft Elastomers and Applications	131
J. Su, J.S. Harrison, T.L. St. Clair, Y. Bar-Cohen, and S. Leary	
Dehydration Time Dependence of Piezoelectric and Mechanical Properties of Bovine Cornea	137
A.C. Jayasuriya, J.I. Scheinbeim, V. Lubkin, G. Bennett, and P. Kramer	
*Novel Polymer Electrets	143
G.M. Sessler and J. Hillenbrand	
Polarization Stability of Amorphous Piezoelectric Polyimides	153
C. Park, Z. Ounaies, J. Su, J.G. Smith, Jr., and J.S. Harrison	
A Study of Liquid Crystalline Elastomers as Piezoelectric Devices	159
A.G. Biggs, K.M. Blackwood, A. Bowles, S. Dailey, and Alison May	

CONDUCTIVE POLYMERS

*Poly(SNS) Electrochemical Synthesis and Processability	167
T.F. Otero, S. Villanueva, E. Brillas, and J. Carrasco	
<i>In Situ</i> Conductivity of Poly(3,4-ethylenedioxythiophene) Electrosynthesized in Aqueous Solutions in the Presence of Large Anions	173
H.J. Ahonen, J. Lukkari, and J. Kankare	
Hyperbranched Conductive Polymers Constituted of Triphenylamine	179
S. Tanaka, K. Takeuchi, M. Asai, T. Iso, and M. Ueda	
Conduction Behavior of Doped Polyaniline Under High Current Density and the Performance of an All Polymer Electromechanical System	185
Haisheng Xu, V. Bharti, Z-Y. Cheng, Q.M. Zhang, Pen-Cheng Wang, and A.G. MacDiarmid	
Comparative Study of Solvent Effect on the Electrochemical Deposition of Polythiophene and Polybithiophene	191
T.K.S. Wong and X. Hu	
 *Invited Paper	

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978-1-107-41326-9 - Materials Research Society Symposium Proceedings: Volume 600:

Electroactive Polymers (EAP)

Editors: Q. M. Zhang, Takeo Furukawa, Yoseph Bar-Cohen and J. Scheinbeim

Frontmatter

[More information](#)

EQCM and Quartz Crystal Impedance Measurements for the Characterization of Thiophene-Based Conducting Polymers	197
C. Arbizzani, F. Soavi, and M. Mastragostino	
Polythiophene Grafted on Polyethylene Film	203
N. Chanunpanich, A. Ulman, Y.M. Strzhemechny, S.A. Schwarz, J. Dornicik, M. Rafailovich, J. Sokolov, A. Janke, H.G. Braun, and T. Kratzmüller	
A Conductive Composite Film by Permeation Method	209
Jin Wei Wang and M.P. Srinivasan	
Electrochemical Investigation of 2,2'-diaminobenzyloxydisulfide	215
Y.Z. Su and K.C. Gong	
On the Nature of Heterogeneity in Vacuum Deposited Polyaniline Films	221
V.F. Ivanov, A.A. Nekrasov, K.V. Chebryako, O.L. Gribkova, and A.V. Vannikov	

POLYMER GELS AND MUSCLES

*Polymer Electrolyte Actuator Driven by Low Voltage	229
K. Oguro, K. Asaka, N. Fujiwara, K. Onishi, and S. Sewa	
*Polymer-Gel Phase-Transition as the Mechanism of Muscle Contraction	237
Gerald H. Pollack	
Biochemical Synthesis and Unusual Conformational Switching of a Molecular Complex of Polyaniline and DNA	249
Ramaswamy Nagarajan, Sukant K. Tripathy, Jayant Kumar, Lynne A. Samuelson, and Ferdinando F. Bruno	
Enzymatic Template Synthesis of Polyphenol	255
Ferdinando F. Bruno, Ramaswamy Nagarajan, Jena S. Sidhartha, Ke Yang, Jayant Kumar, Sukant Tripathy, and Lynne Samuelson	
The Constitutive Response of Active Polymer Gels	261
S.P. Marra, K.T. Ramesh, and A.S. Douglas	

*Invited Paper

Electroactive Nonionic Polymer Gel—Swift Bending and Crawling Motion 267
T. Hirai, J. Zheng, M. Watanabe, H. Shirai, and M. Yamaguchi

Effect of the Pore Formation on the Solution Flow Through Acrylamide Gel 273
H. Tamagawa, S. Popovic, and M. Taya

COMPOSITES AND OTHERS

High Dielectric Constant Polymer Ceramic Composites 281
Y. Bai, V. Bharti, Z-Y. Cheng, H.S. Xu, and Q.M. Zhang

The Voltage and Composition Dependence of Switching in a Polymer Current Limiter Device 287
Anil R. Duggal

Smart Polymer Composite Thermistor 293
Ralf Strümpfer and Joachim Glatz-Reichenbach

Fast Proton Conductors From Inorganic-Organic Composites:
I. Amorphous Phosphate-Nafion and Silcophosphate-PMA/PWA Hybrids 299
Yong-Il Park, Jae-Dong Kim, and Masayuki Nagai

Fast Proton Conductors From Inorganic-Organic Composites:
II. Amorphous Phosphate-PTFE and ZrP-PTFE Composites 305
Yong-Il Park, Jae-Dong Kim, and Masayuki Nagai

Dielectric Relaxation Spectroscopic Measurements on a Novel Electroactive Polyimide 311
Saadi Abdul Jawad, Abdalla Alnajjar, and Mamoun M. Bader

Computer Controlled Pulsed PECVD Reactor for Laboratory Scale Deposition of Plasma Polymerized Thin Films 325
P.D. Pedrow, L.V. Shepsis, R. Mahalingam, and M.A. Osman

Author Index 333

Subject Index 335

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Frontmatter

[More information](#)

PREFACE

For many years, electroactive ceramic, magnetostrictive material and shape memory alloys have been the primary source of actuation materials for manipulation and mobility systems. Electroactive polymers (EAP) received relatively little attention due to their limited capability. In recent years, effective EAP materials have emerged changing the paradigm of these materials' capability and potential. Their main attractive characteristic is the operation similarity to biological muscles where under electrical excitation a large displacement is induced. The potential to operate biologically inspired mechanisms using EAP as artificial muscles and organs is offering exciting applications that are currently considered science fiction.

This MRS symposium, "Electroactive Polymers," held November 29–December 1 at the 1999 MRS Fall Meeting in Boston, Massachusetts, was initiated for the first time this year in an effort to promote technical exchange of EAP research and development as well as provide a forum for progress reports. The symposium has the input from the international mix in participation. Eminent EAP researchers from the U.S.A., Japan, and Europe presented Invited Papers covering the cutting edge of their material state of the art capabilities and limitations. Generally, two groups of materials were covered: Dry - including electrostrictive, electrostatic, piezoelectric, and ferroelectric; as well as Wet - including IPMC, nanotubes, conductive polymers, gels, etc. While overall the dry types require high voltage for their operation, they provide larger mechanical energy density and they can hold a displacement under a DC voltage, and some of the DRY EAP are capable of operating to high frequencies (>10 kHz). On the other hand, the WET EAP are superior in requiring low actuation voltage ($\sim$ a few volts) with high strain generation capabilities, but are sensitive to drying, and some have difficulties holding a displacement under DC activation.

This proceedings volume brings together many of the oral and poster presentations at the symposium and includes papers on the following topics:

- ▼ EAP applications and their characterizations
- ▼ Ferroelectric based polymers
- ▼ Piezoelectric, electrostrictive polymers, and high strain dielectric elastomers
- ▼ Polymer gels and biological muscles
- ▼ Conductive polymers
- ▼ Polymer composites
- ▼ EAP synthesis and processing
- ▼ Models and analysis of EAP

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Frontmatter

[More information](#)

We hope this volume can provide a resource for the future development in this exciting interdisciplinary field. Clearly, the EAP developed offer great potential in many applications, and also challenge to improve them further to meet the great expectations.

Q.M. Zhang
Takeo Furukawa
Yoseph Bar-Cohen
J. Scheinbeim

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Frontmatter

[More information](#)

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Frontmatter[More information](#)**MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS**

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