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Published in:
Smart Materials and Structures

Link to article, DOI:
10.1088/0964-1726/22/10/100301

Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

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2013 Smart Mater. Struct. 22 100301

(http://iopscience.iop.org/0964-1726/22/10/100301)

Smart Mater. Struct. **22** (2013) 100301 (2pp) doi:10.1088/0964-1726/22/10/100301

PREFACE

Electromechanically active polymer transducers: research in Europe

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Smart materials and structures based on electromechanically active polymers (EAPs) represent a fast growing and stimulating field of research and development. EAPs are materials capable of changing dimensions and/or shape in response to suitable electrical stimuli. They are commonly classified in two major families: ionic EAPs (activated by an electrically induced transport of ions and/or solvent) and electronic EAPs (activated by electrostatic forces).

These polymers show interesting properties, such as sizable active strains and/or stresses in response to electrical driving, high mechanical flexibility, low density, structural simplicity, ease of processing and scalability, no acoustic noise and, in most cases, low costs.

Since many of these characteristics can also describe natural muscle tissues from an engineering standpoint, it is not surprising that EAP transducers are sometimes also referred to as 'muscle-like smart materials' or 'artificial muscles'. They are used not only to generate motion, but also to sense or harvest energy from it. In particular, EAP electromechanical transducers are studied for applications that can benefit from their 'biomimetic' characteristics, with possible usages from the micro- to the macro-scale, spanning several disciplines, such as mechatronics, robotics, automation, biotechnology and biomedical engineering, haptics, fluidics, optics and acoustics.

Currently, the EAP field is just undergoing its initial transition from academic research into commercialization, with companies starting to invest in this technology and the first products appearing on the market.

This focus issue is intentionally aimed at gathering contributions from the most influential European groups working in the EAP field. In fact, today Europe hosts the broadest EAP community worldwide. The rapid expansion of the EAP field in Europe, where it historically has strong roots, has stimulated the creation of the 'European Scientific Network for Artificial Muscles—ESNAM', entirely focused on EAPs and gathering the most active research institutes, as well as key industrial developers and end users. The ESNAM network has received financial support from the European COST (Cooperation in Science and Technology) programme (COST Action MP1003), leading to fruitful collaboration, of which some results are showcased in this issue.

This focus issue deals with a number of relevant topics on ionic and electronic EAPs. The contents, which span highly heterogeneous and cross diverse disciplines, such as physics, chemistry, material science and engineering, embrace size scales from nano to macro, and cover different areas, such as new materials, devices and applications.

This collection of papers helps elucidate, on the one hand, how heterogeneous and dynamic the EAP field is in general and, on the other hand, the state of the art of the EAP research in Europe.

We hope that this focus issue might help to stimulate future work in this emerging field of research and generate new applications.

Acknowledgments

We would like to thank all the authors for their contributions, and the *Smart Materials and Structures* Editor-in-Chief, Professor Garcia, for having accepted our proposal to organize this focus issue. Special thanks also go to Natasha Leeper, from the IOP Publishing team, for her continued support and impeccable professionalism in arranging this focus issue. We also gratefully acknowledge financial support from COST (European Cooperation in Science and Technology) in the framework of 'ESNAM—European Scientific Network for Artificial Muscles' (COST Action MP1003), which made possible cooperation that led to contributions to this issue.