Soft Matter, Biological Materials and Biomedical Materials – Synthesis, Characterization and Applications

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Soft Matter, Biological Materials and Biomedical Materials – Synthesis, Characterization and Applications

Symposium held November 29–December 3, Boston, Massachusetts, U.S.A.

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MULTISCALE MECHANICS OF HIERARCHICAL BIOLOGICAL, BIOINSPIRED, AND BIOMEDICAL MATERIALS

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PREFACE

Symposium V, "Harnessing Instabilities in Soft Material Films and Interfaces," Symposium NN, "Biomineralization and Bioinspired Inorganic and Inorganic/Organic Materials," Symposium OO, "Multiscale Mechanics of Hierarchical Biological, Bioinspried, and Biomedical Materials," and Symposium PP, "Materials and Sensors for Biomedical Applications," were held Nov. 29–Dec. 3 at the 2010 MRS Fall Meeting in Boston, Massachusetts. This volume contains the joint proceedings based on these four symposia.

Although organized by separate teams of scientific and engineering researchers, these symposia explore a common theme of how biological and soft material properties may be harnessed to build new structural features or elicit useful structural responses, either to understand the fundamental chemical and mechanical principles, or to design practical sensors and metrology tools.

Symposium V explored how mechanical instabilities in soft materials may be utilized to template new engineering designs or to provide novel methods of measuring interfacial properties that may be difficult to quantify using other means. As such, this symposium provided a forum for materials scientists and engineers to explore fundamental principles behind the mechanics of instabilities in soft systems, as well as the practical applications for such instabilities in fields ranging from surface patterning to stretchable/flexible electronics.

Symposium NN examined topics related to biomineralization and bioinspired strategies for templating inorganic and inorganic/organic material hybrids. A key theme of this work is the use of large organic materials to template larger-scale structural order by mediating the distribution of material at the molecular and larger crystallite scales. Because intricate hierarchical structures attainable through biomimetic approaches give rise to superior or unique properties compared to traditional materials and composites, these materials are uniquely poised to meet future requirements for more specific electrical, optical, mechanical and biological property design and control.

Symposium OO focused on both computer simulation and laboratory-based research from various areas related to mechanics of materials, including molecular mechanics, micromechanics, continuum methods, multi-scale methods, numerical methods and experiments. In particular, the mechanical response in biological and bio-replacement systems at multiple length-scales was considered. In addition, the role of mechanics at the cellular and tissue level, its medical implications, and the link between genetics and material properties were discussed.

Symposium PP provided a forum for scientists and engineers active in the fields of physics, chemistry, biology, materials science, biotechnology, biomedical engineering and electrical engineering to present recent developments of biosensors and their applications in biotechnology. A key challenge facing such work is how to adjust materials properties to enable sophisticated detection schemes in a highly integrated

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manner. Resulting designs generally incorporate a broad range of materials (noble metals, ceramics, semiconductors, polymers, etc.) and structures (optical gratings, waveguides, resonant cavities, MEMS/NEMS, etc.). Challenges in this field are best addressed by interdisciplinary collaborations and communication between various science and engineering disciplines. Building such collaborations was a primary goal of all of the symposia represented in this volume.

The symposium editors would like to thank the staff of Materials Research Society and Cambridge University Press for making this proceedings volume possible. We also give thanks to the authors, participants, and reviewers of the proceedings volume. We hope that this issue becomes a useful resource that signifies the leadership of the Materials Research Society in these topic areas, and that it might provide a springboard for future interdisciplinary collaborations to meet the growing challenges of material design.

Adam Nolte
Kiyotaka Shiba
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April 2011

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