Multiscale Characterization of Biological Systems

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Spectroscopy and Modeling

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To Samarth, Yash, and Swati

Preface

Inspired by a remarkable combination of physical and mechanical properties in biological materials, a new research field has evolved that focuses on studying these materials for the underlying principles and mechanisms of operation in order to incorporate such into the engineered materials. This field or stream of materials science referred to as "Bioenabled and Biomimetic Materials" has attracted imagination of a range of scientific disciplines. The key of natural- or nature-inspired design of materials is different, organized scale levels (nano- to macroscale) of structural arrangement with the presence of the interface between the organic and inorganic phases at each level. The accurate knowledge of such design principle is needed to optimize performance of biomimetic materials for required loading condition and operation. Two aspects of this knowledge are the accurate characterization of the organic–inorganic interfaces and the quantitative study of the contributor of different interfaces and structural arrangements to the consequent improvements in mechanical properties (e.g., stiffness, strength, toughness, etc.). Another important aspect of this design is the development of an ability to better manufacture traditionally developed composites. This collection focuses on the work done by Interfacial Multiphysics Lab and collaborators on the first aspect. The field of biomimetic materials is still in its beginning and growing. This work's primary contribution is in its focus on interfaces from the point of views of experiments and multiscale models.

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this area. Permission was obtained for figures borrowed to appear in review papers and book chapters on which the book is based. We remain indebted for the related colleagues for providing required permissions.

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