Preface

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Biographical notes: Pablo D. Zavattieri is an Associate Professor of Civil Engineering of the Lyles School of Civil Engineering and University Faculty Scholar at Purdue University. He joined Purdue in 2009 after working for General Motors (GM) at Research and Development Center (2001–2009) where he led research activities in the general areas of computational solid mechanics, smart and biomimetic materials. His current research lies at the interface between solid mechanics and materials engineering, looking at how Nature uses elegant and efficient ways to make remarkable and more sustainable materials. He is the recipient of the NSF CAREER award, and received various awards during his academic career.

This special issue of *IJECB* includes a fine representation of the high quality work presented at the Pan American Advanced Studies Institute (PASI) on *Polymer and Composite Materials from Renewable Resources and Biorefinery: from Chemistry to Applications*, which was held in Costa Rica in 2013. As an active and continuously growing area of research, polymers and composite materials from renewable resources attempt to explore new paradigms of design and development of advanced materials with exceptional properties. Nanocellulose and lignin are emerging as excellent candidates for environmentally friendly and multifunctional materials. Although this opens the door to a whole set of new materials with various structural and functionality requirements, a comprehensive understanding of these materials is needed. The paper by Jairo Diaz, Julia Braun, Robert Moon and Jeffrey Youngblood entitled 'Iridescent cellulose nanocrystal/polyethylene oxide composite films with low coefficient of thermal expansion' reports some of the recent advances in the area of cellulose nanocrystals (CNCs) for applications such as organic electronics. The group at Purdue incorporated CNCs into a polyethylene oxide matrix following a chiral nematic organisation that yields an iridescent optical reflection, and yet a low coefficient of thermal expansion which makes the new material very attractive for selective optical bandgap materials while tuning the CTE. On the other hand, the paper by Luke Gibbons, Madeline Smith and Rafael L. Quirino from Georgia Southern University, entitled 'Modified lignin for composite and pellet binder applications' where they show that cross-linking lignings with divinylbenzene yields materials with properties suitable for pellet binders, as well as for bio-based resins for the preparation of biocomposites.

Ana Cadena-Nogales, Alejandro Martiz and Miguel Angel Mendez from Universidad San Francisco de Quito (Ecuador) presented the work entitled 'Monte Carlo adsorption affinity studio of modified nano-montmorillonite for the removal of chromate ions' where they used computational tools to explore the adsorption of chromate (CrO_4)

contaminant on nano-montmorillonite modified by two biosurfactants. These materials will have a significant impact on water treatment. Finally, the work by MariAnne Sullivan, Yan Chen and Bart Prorok from Auburn University, entitled 'New strengthening mechanisms of nacre in the abalone shell' explored the growth of mesolayers in farm-raised and wild abalones and the influence of very modest changes in temperature on the mechanical behaviour. This is very important as we now know that for engineering materials, there exists an inverse relation between pairs of desired properties (e.g., stiffness vs. toughness). On the other hand, Nature has evolved efficient strategies to synthesise materials that often exhibit exceptional mechanical properties that significantly break the conventional trade-offs often required in man-made materials. In fact, most highly mineralised biological materials, such as nacre, achieve high toughness without sacrificing stiffness and strength by control of nano- and microstructural features that significantly improve the mechanical performance of otherwise brittle materials. By looking at the structure-function relationship in these materials, we can develop new methods to create low cost, environmentally friendly, ultra-high performance architectured materials and structures that are inspired by Nature.

A few words from the PASI organisers

This special issue of *International Journal of Experimental and Computational Biomechanics* (*IJECB*) contains contributions from authors who attended a NSF-sponsored PASI, which was held in Costa Rica in 2013 under the topic of 'Polymer and composite materials from renewable resources and bio-refinery: from chemistry to applications'. It is also a product of the efforts intended to develop strategies for promoting collaborative research and training in related domains between the USA.

Seventy-five Hispanic undergraduate and graduate students from the USA and the US territory participated in the activities and comprised an audience of interdisciplinary scholars: graduate students from chemistry, physics, biology, and engineering, as well as scientists and young professors. During two weeks of intensive work and discussions, the participants generated a knowledge platform and collaborated in order to start a network that is still expanding. This training and educational workshop was unique in its coverage of multidisciplinary aspects of green science, ranging from the chemistry to the applications of green polymers and composites. It is not by chance that the contributing papers also reflect such aspects, which we hope will be appreciated by the readership of *IJECB*.

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