Title: A New Horizon in Engineering Sciences: Biomimetic Multifunctional Materials

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Abstract
Multifunctional structural materials possess attributes beyond the basic strength, stiffness that typically drive the science and engineering of the material for structural systems. The structural materials can be designed to have integrated electrical, magnetic, optical, locomotive, power generative, and other functionalities that work in synergy to provide advantages that reach beyond that of the sum of the individual capabilities. Materials of this kind have tremendous potential to impact future structural performance by reducing size, weight, cost, power consumption and complexity while improving efficiency, safety, and versatility. Nature offers numerous examples of materials that serve multiple functions. Biological materials routinely contain sensing, healing, actuation, and other functions built into the primary structures of an organism. In this lecture, I will examine the current state-of-the-art and the challenges that must be met in order to integrate multiple functions into fiber-reinforced polymers to create composites with basic structural attributes that can also possess tuned thermal, electromagnetic, self-healing, environmental sensing, self-prognosis, and energy harvesting functionalities.

Sia Nemat-Nasser, Distinguished Professor in Mechanics and Materials, is a member of the National Academy of Engineering; Life Fellow of ASCE and ASME; Fellow of American Academy of Mechanics (AAM) and Society of Engineering Science (SES); and foreign fellow of the Danish Center of Applied Mathematics and Mechanics. He has been president, vice-president, and director of the SES, and has served as secretary and president of the AAM, and chair of the Materials Division of ASME. He has received the Technical University of Crete's Gold Medal (1997); the 2002 SES William Prager Medal in Solid Mechanics; the 2002 ASME Nadai Medal; the 2003 International Technology Institute's Willard F. Rockwell Medal, and elected honorary member of the World Innovation Foundation. Three times (1994-95, 1996-97 and 2000-01) has been selected by the graduating seniors as the best teacher of the year, and has graduated over 40 Ph.D.’s.


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