Towards a Paradigm Shift in Multifunctional Materials

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Over the past decade significant progress has been made in the development of multifunctional materials, which seek to combine multiple material behaviors or properties into a single component. However, the system level benefits offered by multifunctional materials often come at a price, with the performance in each functionality alone being inferior. The ultimate goal for multifunctional materials is not only to consolidate systems, but also simultaneously improve the behavior in each use. The creation of such a material would yield a paradigm shift and open clear pathways to the acceptance of this new class of materials. This talk will discuss a methodology to yield new materials with the potential to achieve this goal. Our efforts primarily focus on the use of geometric anisotropy to achieve both local reinforcement of a composite material while imparting a variety of functionalities ranging from embedded sensing and actuation to self-healing. Our efforts to understand the mechanisms responsible for the improved behavior will be discussed along with our current efforts to develop new materials which capitalize upon the principle learned to achieve further material gains. Lastly, our efforts to develop self-healing polymers with mechanical behavior comparable to composite grade epoxies will be discussed.

Bio: Dr. Sodano is an Associate Professor in the Aerospace Engineering Department at the University of Michigan with appointments in the Materials Science and Engineering and Macromolecular Science and Engineering Departments. His research lies in advanced materials with focus on composite materials, multifunctional materials, additive manufacturing, ceramics and nanotechnology. He received his Ph.D. in Mechanical Engineering from Virginia Tech in 2005, his M.S. in 2003 and his B.S in 2002 also from Virginia Tech. He has published 195 technical articles (6 book chapters, 96 refereed journals published or submitted and 92 proceedings) and made over 100 international presentations including his selection for a presentation at the National Academy’s 2008 German-American Frontiers of Engineering Symposium. He currently serves as an associate editor of four journals and was awarded the NSF CAREER award in 2009, the American Society of Composites Young Researcher Award in 2012, the ASME Gary Anderson Award for Early Career Achievement in 2009, Virginia Tech’s 2010 Outstanding Recent Alumni Award, Arizona State University’s 2009 Faculty Achievement Award in Research Excellence, NASA Tech Brief Awards in 2010 and 2014, and was inducted into Virginia Tech’s Academy of Engineering Excellence in 2010.