

MECHANICAL ENGINEERING

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Micro/nano Mechanics and Nanotribology of Flexible Multilayer Nanocomposites

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Abstract

There have been significant developments in advanced polymer-based multilayer nano/micro composites. Potential applications are in gas barriers, water membranes, optoelectronic devices, biosensors, corrosion inhibitors, energy devices, and wearable electronics. They are finding their ways as replacement of traditional metal, silicon oxides and hard inorganic coatings. In this presentation we show the fabrication of new polymer flexible nanocomposites and their mechanical response against normal and lateral deformation modes, using nanoindentation and nanoscratch techniques. Based on these experiments, functional multilayered polymeric coatings consisting of different arrangements of polymers, graphene oxide and clay were found to be potential material choices for a range of different applications such as low-friction tribological coatings, vapor/gas barriers and self-healing coatings. Furthermore, 3D silicon/polymer structures specifically under extreme deformation were found to be as potential candidates for wearable electronics and flexible microelectromechanical system sensors due to the resilient and elastic behavior driven by the geometry-dependent deformation of these structures.

Biography

Dr. Polycarpou received his Ph.D. from the University at Buffalo in 1994. Before joining Texas A&M in 2012, he was the Wilkins Professor and Associate Department Head at the University of Illinois Urbana-Champaign. Before that, he was a post-doctoral fellow at the Technion and a staff scientist at Seagate Technology. Dr. Polycarpou's research interests include tribology, micro/nanotribology, nanomechanics, microtribodynamics, and advanced interface materials. Emphasis has been on micro/nanoscale contact problems with application to micro-devices, as well as the tribology of devices for reduced energy and improved environmental-related impact. Polycarpou is the author of 200 archival journal papers, numerous book chapters, volume proceedings, and a dozen patents. Polycarpou won numerous national and international awards, including the ASME Newkirk Award, the NSF faculty CAREER Award, the Xerox Award for Faculty Research, the STLE Bisson Award, a Fulbright Scholar, the ASME Johnson Best Paper Award, the STLE Hodson Award, and the ASME Hersey Award. Polycarpou is active in the tribology and mechanics communities, where he served in many posts, including Chairing the ASME Tribology Division. He was also an Associate Editor for the ASME Journal of Tribology, serves on several Editorial Boards and has organized numerous conferences. Dr. Polycarpou also served on several honors and awards committees and is the past Chair of the Executive committee of ASME's Department Heads Council.