



ME Department Seminar

Tribology of thin films for next generation material systems including extreme high temperature conditions



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Abstract:

Modern devices that include rubbing components are expected to meet higher performance requirements under extreme operating conditions, thus rendering traditionally low cost materials and liquid lubrication ineffective. Tribology has emerged as one of the fields that contribute to the solution of environmental problems through the development of materials, products and solutions less hazardous or harmful to the environment. The air-conditioning and refrigeration industry, for example, has addressed this issue of greener technology shifting its attention towards advanced compressors that use environmentally friendly refrigerants and oil-less conditions. Similar cases are currently under investigation for oil & gas/energy applications. Under oil-less conditions, it becomes necessary to implement some type of advanced protective coatings on the interacting surfaces to withstand stringent rubbing conditions. Extreme operating conditions also include high to very high temperatures up to 1000°C. In this presentation, we present recent work using several polymeric-based high bearing coatings, including PTFE-based, PEEK-based and a newly developed aromatic thermosetting polyester (ATSP) -based coating. Some of the ATSP-based coating systems exhibited almost zero wear under both dry and boundary lubricated conditions. We also present work on a high temperature coating (HfB₂-based) that is currently under development for extremely high temperature conditions.

Bio:

Dr. Polycarpou received his Ph.D. from the University at Buffalo. Before joining Texas A&M in 2012, he was the Wilkins Professor and Associate Department Head at the University of Illinois Urbana-Champaign. He was also the Founding Department Chair of Khalifa University (Abu Dhabi) from 2011-2012, while on leave from the University of Illinois. 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/nano tribology, nano mechanics, and advanced interface materials. Recent 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 about 200 archival journal papers, and numerous book chapters, volume proceedings, a dozen patents and conference papers. Polycarpou won numerous national and international awards, including the ASME Burt L. Newkirk Award, the National Science Foundation Faculty CAREER Award, the Xerox Award for Faculty Research, the STLE Edmond E. Bisson Award, a Fulbright Scholar, the ASME K.L. Johnson Best Paper Award and the STLE Walter D. Hodson 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, has organized numerous conferences including being the Chair of the 2009 International Joint Tribology Conference. Dr. Polycarpou is currently serving on several honors and awards committees, as well as on the Executive committee of ASME's Department Heads Council.