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Biography: Dr. Myung S. Jhon is a Professor of Chemical Engineering, and a member of both the Data Storage Systems Center and the Institute for Complex Engineered Systems at Carnegie Mellon University in Pittsburgh, PA. He is a visiting professor at the National Energy Technology Laboratory, a Corporate Science and Technology Advisor of Mitsubishi Chemical Corporation (Japan), Advisory Committee Member in the National Program for Tera-level Nanodevices, and the lead organizer for the first U.S.-Korea Nanotechnology forum. He also serves as a member of the international advisory boards for both the Journal of Industrial and Engineering Chemistry and Polymer (Korea). He is an elected Foreign Member of the Korean Academy of Science and Technology, and is internationally known for his work in the fields of information technology, nanotechnology, polymer engineering, and computational physics. He has contributed 626 publications (364 refereed publications, 241 technical reports, and 21 e-publications) in the areas of tribology, polymers, nanotechnology, interfacial dynamics, chemical kinetics, molecular simulations, electrorheology, and computational fluid dynamics.

Dr. Jhon received his B.S. in Physics from Seoul National University, Korea, and his Ph.D. in Physics from the University of Chicago (U.S. citizen). He has served as a visiting professor in several institutions, including the U.S. Department of Energy (National Energy Technology Laboratory and Sandia National Laboratories); the Department of Chemical Engineering, University of California, Berkeley; IBM Almaden Research Center, San Jose; and the Naval Research Laboratory, Washington, D.C. He has also served as a consultant to the United Nations Industrial Development Organization. Currently, he is a Carnegie Institute of Technology faculty Chair-Elect and is dedicated to the educational process, as is evident from his roles as an ABET evaluator and undergraduate chair. He has won a number of teaching and research recognition awards, including the Ladd, Teare, Ryan, Dowd, and Li awards.

Title: "A Study of Perfluoropolyether Lubricant Films"

Abstract: We will present the fundamental scientific tools, as well as constructs cohesive schemes for the molecularly thin polymeric liquid film technology. Our goal is to understand the nanoscale dynamic behavior of thin lubricant films, relevant to the emerging field of nanotechnology, especially for achieving durability and reliability in nanoscale devices.

Our talk focuses on a unified and hybrid description of perfluoropolyether (PFPE) experiment, mesoscopic interpretation, microscopic simulation tool, and molecular design tools. A method for extracting spreading properties from the scanning microellipsometry (SME) for various PFPE/solid surface pairs and the rheological characterization of PFPEs are examined at length. The solvent effects on the media noise are also discussed via rheological measurements. The interrelationships among SME spreading profiles, surface energy, rheology, and tribology are discussed as well. Mesoscopic theories, including thermodynamics of evaporation, stability analysis, microscale mass transfer, and capillary waves are introduced to describe thin PFPE film dynamics. The lattice-based simple reactive sphere model for qualitatively examining the fundamentals of PFPE dynamics are illustrated. An off-lattice based, coarse-grained, bead-spring Monte Carlo technique is also introduced to capture a detailed internal structure of PFPE molecules, and the molecular dynamics simulation with Langevin equation is implemented for a full-scale dynamic structural analysis of PFPE thin films. By systematically tuning the endgroup strengths of PFPE, we examined the physicochemical properties of nanostructural lubricant films for the various PFPE/solid surface pairings. These tools will accurately describe the static and dynamic behaviors of PFPE films consistent with experimental findings and provide suitable starting point for describing the fundamental mechanisms of lubrication in nanoscale devices. These tools will also be suitable for describing the fundamental mechanisms of film dewetting and rupture due to instability arising from temperature and pressure inhomogeneities. The fractal dimension and surface morphology are also introduced for potential use for fingerprint analyses of PFPE molecule/solid surface pairs. The next generation head-disk interface design in information storage device is also discussed briefly.