

Materials Science & Engineering Seminar Series

Surface Technologies for Demanding Tribological Applications: From Super-hard & Low-friction Coatings to Super-fast Surface Treatments



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During the last two decades, there has been considerable interest in the development and diverse utilization of novel coatings that can enhance performance, efficiency and reliability of mechanical systems. Among others, the development of super-hard and low-friction nanocomposite coatings has attracted the most attention because of their unique abilities to provide superior performance under severe conditions. Most of these novel coatings consist of unique chemical and structural architectures and can only be achieved by the use of advanced arc and magnetron sputtering processes equipped with robust power sources like HiPIMS, pulsed DC and cathodic arc. The primary focus of this talk will be on the chemical and structural design of a new class of MoN-based nanocomposite coatings for super-low friction and wear properties under severe boundary conditions. For the structural and chemical design of such coatings, we will introduce a crystal-chemical model that can be very useful in the selection of coating ingredients which appear to be essential for their superior friction, wear, and scuff properties under lubricated conditions. Recent results are presented to demonstrate the superior tribological properties for these designer coatings over a broad range of sliding conditions. Tribological properties of engineering materials can also be improved by a variety of well-established surface treatments like nitriding, carburizing, and boriding which are used extensively today by industry in all types of engineering components despite being very time and energy consuming. A novel super-fast surface treatment method: ultra-fast boriding will also be introduced and the initial test results from a variety of borided materials will be presented. The talk will be concluded with a future outlook for both the super-hard coating and super-fast surface treatment technologies.

Dr. Ali Erdemir is a Distinguished Fellow of Argonne National Laboratory. He received his B.S. in Metallurgy from Istanbul Technical University in 1977; and his M.S. and Ph.D. degrees in Materials Science & Engineering from Georgia Tech in 1982 and 1986. Dr. Erdemir's research interest includes surface engineering and tribology and super-hard and -low friction materials and coatings. In recognition of his innovative research, he has received several prestigious awards and honors, including four R&D-100 Awards, two Al Sonntag and an Edmond E. Bisson Awards from the Society of Tribologists and Lubrication Engineers, the Innovative Research Award of the Tribology Division of ASME. He is a Fellow of AVS, ASME, STLE, and ASM-International. He authored/co-authored more than 140 refereed journal articles, 16 book/handbook chapters, edited two books, and holds 15 U.S. Patents.

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