IOWA STATE UNIVERSITY
Department of Mechanical Engineering

How Fundamental Behavior in Mechanical Interfaces during Scuffing Impacts System Level Response

Dr. Stephen Berkebile
Drives and Tribology Team Lead
Vehicle Power and Propulsion Branch
US DEVCOM Army Research Laboratory
Faculty host: Sougata Roy

Seminar on March 19th, 2024 at 11:00 AM in 2004 Black Engr.

Abstract First, I will provide a short overview of some research areas within the Vehicle Power and Propulsion Branch at the U.S. Army DEVCOM Army Research Laboratory. Second, I will take a deeper technical dive into the phenomenon of "scuffing" in mechanical systems. Scuffing occurs in many mechanical systems due to insufficient lubrication during high sliding and/or loading. Using the example of loss of lubrication in high-speed gearing systems, I will demonstrate the connections of the microstructural and chemical processes at insufficiently-lubricated gear interfaces to the system level response in a helicopter gearbox. Several distinct wear regimes occur in high-speed gears during a loss of lubrication event with oxidation of the gear steel leading to some surprising results on the effectiveness of iron oxide behaving as an emergency solid lubricant. Transitioning to lower sliding speeds, I will present recent work on capturing the microstructural evolution of steel during scuffing events using synchrotron-based X-ray diffraction. The grain refinement that occurs during scuffing is accompanied by the development of an inhomogeneous residual stress that extends much more deeply beneath the surface beyond the obviously deformed material.

Dr. Stephen Berkebile is the Drives and Tribology Team Lead in the Vehicle Power and Propulsion Branch (Mechanical Sciences Division) and a Technical Area Lead in the Versatile Tactical Power and Propulsion (VICTOR) Essential Research Program at the U.S. Army DEVCOM Army Research Laboratory (ARL). He concentrates on the tribology and lubrication science of materials under harsh lubricating conditions, especially considering the interfacial physical and chemical interactions between materials and fluids. Dr. Berkebile received his B.S. in physics, German, and math at Manchester College in North Manchester, Indiana. In 2009, he received a doctoral degree in physics from the University of Graz in Austria. After a stint as a postdoctoral fellow at NASA Glenn Research Center, he joined ARL in 2013. He has authored and co-authored 53 refereed journal articles, 17 proceedings and reports, and 2 patents in tribology, surface science, and thin film deposition with over 2000 citations. Recently, he received the Brad Forch Mentoring ARL Honorary Award (2023) and the Al Sonntag Award for best paper in a year on solid lubricants (2022). He is an Associate Editor for peer-reviewed journal Tribology Transactions; Panelist for Army and NASA proposal review boards; Associate Professor of Materials Science and Engineering at University of North Texas (courtesy appointment); Courtesy student advisor and thesis committee member at Northwestern University; and member of the Society of Tribologists and Lubrication Engineers and the American Physical Society.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

www.me.iastate.edu