**Carbon Lecture Series**

with

**Dr. Seong H. Kim**

Professor of Chemical Engineering and Professor of Materials Science and Engineering  
The Pennsylvania State University

Friday, February 26, 2021  
3:00-4:30pm EST  
Zoom  
(must register to receive link)

“Tribology of Advanced Carbon Materials”

**Abstract:** Diamond-like carbon (DLC) coatings and graphene materials are well known for superlubricity and thus high wear resistance. However, such desired properties are often observed in 'ideal' conditions only and lost in 'practical' conditions. For example, hydrogenated DLC can give ultralow friction in dry nitrogen or vacuum conditions after certain run-in periods, but such behaviors are not observed in ambient air. Friction on graphene or graphite basal plane is also extremely low, which makes them ideal candidates for solid lubricant coating. But, unless the entire solid surface is completely coated with one piece of graphene, there will always be step edge defects in the sliding interface that will cause high friction and potentially undergo tribochemical reactions. This talk will discuss surface science involved in environment dependence of DLC friction and the physical and chemical origins of friction at single-layer graphene step edge as well as graphite basal plane. The knowledge obtained from these fundamental studies can be employed for design of more advanced functional carbon materials that mitigate the parasitic energy loss at sliding interfaces of engineering systems.

**Biographical Sketch:** Dr. Seong Kim's career path has been quite unconventional, but quite innovative and impactful. His educational background was in physical chemistry, but he now teaches and works as Distinguished Professor in the Department of Chemical Engineering at Penn State. His research during the PhD work at Northwestern Univ. and his postdoctoral work at the Univ. of California in Berkeley focused on ultra-high vacuum surface science studies related to heterogeneous catalysis. However, his current research at Penn State is at different frontiers – tribology (a subject perhaps more known in mechanical engineering), silicate glass (usually considered in materials science disciplines), and plant cell walls (also called lignocellulose biomass by engineers). The crux of these seemingly disparate programs is the fundamental understanding of surface science and characterization principles and the application of those principles to research fields that need such expertise, even though they may be outside the comfort zone of his past education and training. In doing so, he has questioned assumptions that others have taken for granted, proposed new alternative hypotheses, listened to criticisms, and improved the proposed theories. Through these efforts, his team has been establishing fundamental knowledge in molecular tribology, glass science, and biological materials that are critically needed for engineering applications. In recognition of his contributions, Dr. Kim has over 300 publications (h-index = 51) and has received numerous awards, including most recently an appointment as Fellow of the Society of Tribologists and Lubrication Engineers, and a Penn State Engineering Alumni Society Premier Research Award for excellence in teaching, research, advising, and service.