



The Department of Chemical Engineering Presents



Prof. Andrew Teplyakov
Professor
University of Delaware

"Atomically-Precise Surface Processes: From Molecular Mechanisms to Realistic Devices"

Abstract: The atomic-level precision in designing surfaces and nanostructures is quickly making its way from the one-off laboratory investigations into chemical manufacturing. However, in order to make the applications feasible, fundamental understanding of the mechanisms of surface reactions leading to the formation of the desired surface structures is needed. A great deal of progress has been made over the years in uncovering reactions behind atomic layer deposition (ALD), but much more limited information is available about atomic layer etching (ALE), although both processes are often required to build the components of present and future microelectronics.

This talk will overview some of the recent research in Teplyakov Laboratory, including nanoparticulate catalysts and semiconductor surface modification, and focus on recent work on understanding the reactions for metal and metal oxide deposition on functionalized (and patterned) surfaces and on recent advances in ALE of complex materials, specifically focused on tertiary alloys, such as CoFeB, used in magnetic tunnel junctions. I will outline the work needed to understand the mechanisms of these processes that can be further used to improve the control over atomically-precise manufacturing methods and to reduce the use of hazardous procedures. The relatively well-understood ALE procedures that include oxidation or chlorination as the first half-cycle of ALE of such materials and introduction of a bidentate ligands (such as acetylacetonates) to remove complex materials uniformly and with atomic-level control will be extended to describe the potential use of much milder conditions and reagents. A combination of experimental and computational methods will be used to make this analysis possible.

Wednesday October 26, 2022
The Gowen Room, 10:30-11:30 am



Bio: ANDREW V. TEPLYAKOV is a Professor of Chemistry and Biochemistry at the University of Delaware. He has completed his undergraduate degree at Moscow State University, Moscow, Russia, in 1992. He received his PhD from Columbia University, New York, NY, in 1997 under the guidance of the late Professor Brian Bent, where he also worked with Professor George Flynn. After receiving his PhD, Andrew held a postdoctoral position in the group of Professor Stacey Bent (currently at Stanford University, Department of Chemical Engineering). Andrew joined the faculty at the Department of Chemistry and Biochemistry at the University of Delaware in 1998. His research is focused on an interdisciplinary area of surface, interface, and thin film science. His group has developed several novel approaches to understanding chemical binding on surfaces of amorphous diffusion barrier films, surface chemistry of multifunctional molecules, surface modification of semiconductor materials in ambient, electron transfer and molecular junctions, specifically electronic properties controlled by surface preparation and modification, and more recently, multicomponent heterogeneous catalyst design and atomic layer etching. This research uses a wide array of surface analytical techniques, microscopic characterization, and computational investigations. It has resulted in over 150 publications and over 120 invited presentations. He is a Fellow of AVS and a member of Surface Science, Frontiers of Materials, and Langmuir Editorial Advisory Boards. He is an Associate Editor of Applied Surface Science.