PHYSICS COLLOQUIUM

Friday, September 23 | 3:15-4:15 p.m. | RNS 210

ST · OLAF COLLEGE

Graduate Research Life & Atomic Layer Processing for Nano-devices

This talk will outline St. Olaf alum, Nathan Eigenfeld's experiences in graduate research in Mechanical Engineering at the University of Colorado at Boulder. He will attempt to illuminate the atmosphere of a large research university and the associated graduate student life style. The rest of the presentation will highlight his past and current research on atomic layer processing for nano-devices, specifically on applications for infrared (IR) imaging applications. By using atomic layer deposition (ALD) and atomic layer etching (ALE) technologies to build and remove materials in single atomic increments and traditional microfabrication techniques, structures on the order of 100's of atoms thick may be built and integrated into functional IR devices. At this scale, the physical properties of materials begin to change drastically as the surface interfaces, granular microstructure and layer boundaries begin to dominate residual stress and electron/phonon transport. By understanding these scaling effects, materials may be designed to achieve desired performance. In addition, adjacent work from his research group using similar atomic layer fabrication approaches will be showcased, including thermo-acoustic speakers and micro-velcro.

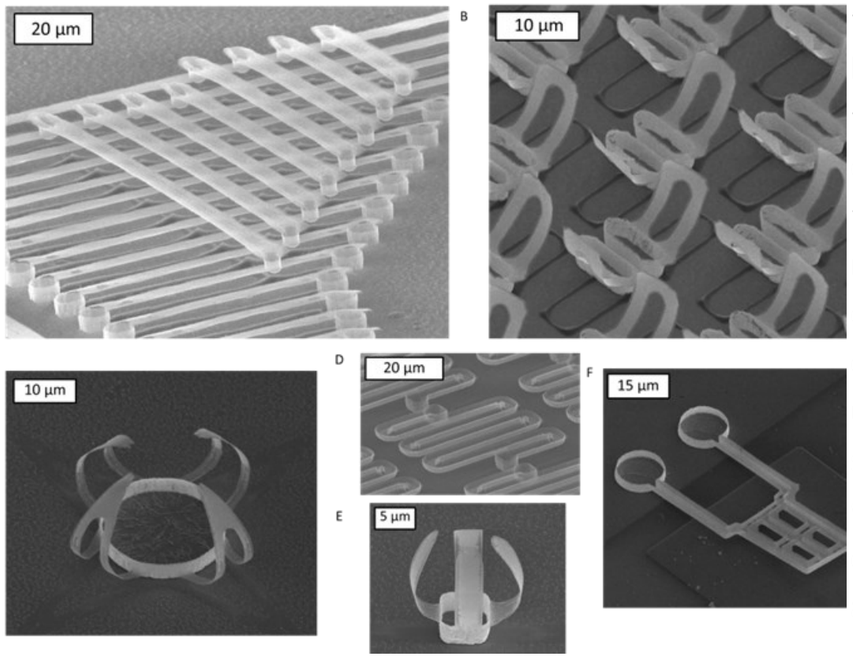
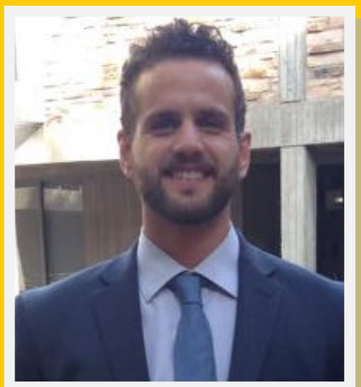


Figure: SEM images of a variety of nano-devices on the order of 15 – 30 nm thick.



Nathan Eigenfeld '11

Nathan (Nate) graduated from St. Olaf College in 2011, earning undergraduate degrees in physics and mathematics. While there, he worked under Professor Brian Borovsky, researching micro friction and the use of self-assembled monolayers as lubricants for micro-electromechanical (MEMS) devices. During a short interim before attending the University of Colorado at Boulder for his PhD studies in mechanical engineering, he worked as a summer intern at Advanced Energy Industries in Fort Collins, CO, working with high power RF plasma chambers. Upon commencement of graduate school in 2011, he joined Professor Victor Bright's MEMS group, working on atomic layer deposition (ALD) films for infrared (IR) sensors known as microbolometers. Nathan successfully defended his PhD in December of 2015 and produced a thesis titled, "Ultra-thin materials from atomic layer deposition for microbolometers". Much of this work revolved around methods to build ultra-thin suspended structures as well as investigations of their material properties, which deviate significantly from their bulk counterparts. Nathan is currently continuing his work in the MEMS group as a post-doctoral research associate. He is studying alternative ultra-thin materials for microbolometer implementation, while also studying how to effectively use a relatively new technology known as atomic layer etching (ALE) in nano-fabrication. When not in the lab, Nathan exercises a healthy skiing addiction, skiing 50+ days a year and chasing storms around the continental Mountain West. He recently has completed his first ever year round ski (each month).