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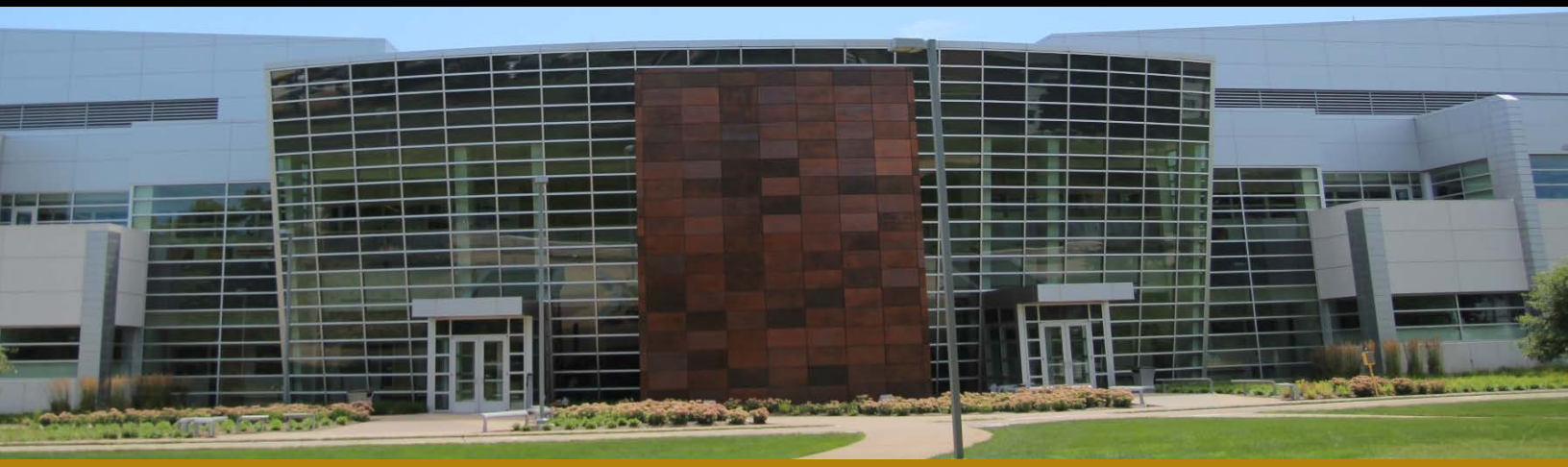

Birck Nanotechnology Center

Nanomanufacturing Preeminent Team Faculty Seminar

Dr. Rahim Rahimi

Laser processing and printing of multilayer films for inexpensive and flexible microsystems

Wednesday, February 28th, 2018

9:30am – 10:30am , BRK 2001

Bio: Rahim Rahimi is a postdoctoral scholar at Purdue University in the department of Electrical and Computer Engineering. He earned his B.S. (2009) and M.S. (2012) degrees in Electrical Engineering from the Iran University of Science and Technology, and his Ph.D. (2017) degree in Electrical and Computer Engineering from the Purdue University, USA. His research has explored development of innovative, scalable, multifunctional, microsystem platforms for medical applications, with particular emphasis on smart wearable and autonomous devices for wound monitoring and therapy. His research on smart dressing for burn victims and stretchable embroidered electronics has been featured in various news media, including Science Nation, Science360, The Computer World, and Science X. During his graduate and post-graduate career, he has co-authored over 50 publications in world renowned journals and international conferences as well as book chapter and patents. Dr. Rahimi has also has led research teams on multi-institutional research endeavors focused on developing scalable manufacturing processes of flexible electronic devices that can empower technologies for health-care and precision agriculture.

Abstract: Flexible/stretchable electronics offer ideal properties for fabricating emerging health monitoring devices that can monitor the user's well-being and their surrounding in a proactive and autonomous fashion. While the attractiveness of these devices are evident, they are often fabricated by conventional cleanroom required techniques that are either expensive or incompatible with rapid large-scale (e.g., roll-to-roll) production, which often prevents their translation into industry for addressing the community needs**.** In this talk, I will present a few inexpensive fabrication technologies that can be utilized for developing various flexible/stretchable physical and chemical sensors for wearable and lab-on-chip applications using novel inexpensive techniques including laser processing and printing. This presentation is divided into two main sections, each showcasing one of these technologies. In the first section, I will describe the use of localized CO_2 laser irradiation to selectively convert thermoset polymer films (e.g., polyimide) into electrically conductive and highly porous carbon micro/nano structures. This process provides a unique and facile approach for direct writing of carbon-based conductive patterns on flexible polymer sheets in ambient conditions, eliminating complexities of current methods such as expensive CVD processes and complicated formulation/preparation of conductive carbon based inks used in inkjet printing. In this section, I will also demonstrate the use of laser ablation for selective patterning of conductive coatings from multilayer films such as ITO-coated PET and metalized paper as a simple and scalable alternative to conventional photolithography-based processes. In the second part of this talk, I will demonstrate a few strategies that were used to leverage printing technologies to create innovative platforms, including Smart dressing for monitoring and treatment of chronic wounds, disposable lab-on-chip diagnostic platforms, and electrochemical sensors for in-situ monitoring of soil nutrients. I will conclude by briefly commenting on our efforts to translate some of these technologies into clinical practice, as well as the future directions of this research and its potential combination with woven and non-woven smart textile-based systems.

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