TcSUH Bi-Weekly Seminar

Flexible Multifunctional Wide-Bandgap Semiconductor Materials and Devices for Energy and Sensing Applications

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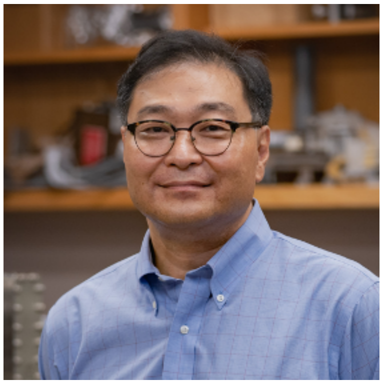
In Person – Room 102, Houston Science Center, 12:00 p.m. – 1:00 p.m.
Sandwiches will be provided on a first-come, first-served basis.



ABSTRACT: This talk will present the recent outcomes of my research team by combining the unique functionality of flexible electronics and wide-bandgap semiconductor materials. Flexible electronics is an emerging and widely explored area. Most research groups in the area focus on fabrication processes to provide mechanical flexibility and their use in bendable and stretchable applications. Also, most semiconductors employed in flexible electronics are non-single-crystalline thin films which compromise the performance of the flexible devices. Instead of the conventional process and application developments in flexible electronics, my group studies new flexible single-crystalline semiconductor materials and fundamental device physics of flexible devices. For the new flexible materials, we developed single-crystalline group-III-nitride (III-N) semiconductor thin films to take advantage of their high critical field strength, wide bandgap energy, piezoelectricity, chemical/thermal stability, biocompatibility, and radiation hardness. For the extension of device physics, we focus on the interaction between mechanical force and device characteristics, such as changes in electronic band structures, mobilities of free carriers, and quantum efficiencies of energy conversion for applications in photonic, electronic, energy, and sensing devices. This talk will specifically address the energy harvesting and sensing devices for two different applications: (1) physical sensors operating in extreme environments such as high operating temperatures (~1000 °C) and radiation exposure and (2) flexible piezoelectric energy harvesters and sensors for self-powered wearable healthcare monitoring systems such as power generators, pulse sensor, eye-movement sensor, cortisol (stress hormone) sensor, glucose sensor, etc.

BIO: Jae-Hyun Ryou received the B.S. and M.S. degrees in Metallurgical Engineering from Yonsei University, Seoul, Korea, and the Ph.D. degree in Materials Science and Engineering in the area of solid-state materials from the University of Texas at Austin, Austin, TX. Before joining the University of Houston, he had several R&D positions in both industry and academia, including Honeywell Technology Center, Honeywell VCSEL Optical Products, and Center for Compound Semiconductors at Georgia Institute of Technology. With research interests in semiconductor materials, nanostructures, and quantum devices, he has been developing new-concept material structures and devices for photonic, electronic, energy, and sensing applications through materials/device structure modeling/design, epitaxial materials growth by chemical vapor deposition and physical vapor deposition, and fabrication process innovations. He has authored or co-authored six book chapters of books, >210 technical journal papers, and >300 conference presentations, and holds 12 U.S. patents with citations of >7600. He is a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and the Optical Society of America (OSA).