Advanced Heterogeneous Integration Enabled by Remote Epitaxy

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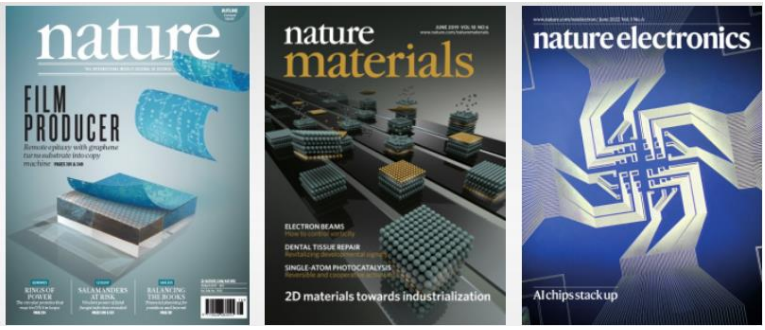

For future of electronics such as bioelectronics, 3D integrated electronics, and bendable electronics, needs for flexibility and stackability of electronic products have substantially grown up. However, conventional wafer-based single-crystalline semiconductors cannot catch up with such trends because they are bound to the thick rigid wafers such that they are neither flexible nor stackable. Although polymer-based organic electronic materials are more compatible as they are mechanically complaint and less costly than inorganic counterparts, their electronic/photonic performance is substantially inferior to that of single-crystalline inorganic materials. For the past half a decade, my research group at MIT has focused on mitigating such performance-mechanical compliance dilemma by developing methods to obtain cheap, flexible, stackable, single-crystalline inorganic systems. In today's talk, I will discuss about our strategies to realize such a dream electronic system and how these strategies unlock new ways of manufacturing advanced electronic systems. I will highlight our remote epitaxy technique that can produce single-crystalline freestanding membranes including III-nitrides, III-V and complex oxide system with their excellent semiconducting performance. In addition, I will present unprecedented artificial heterostructures enabled by stacking of those freestanding 3D material membranes, e.g., world's smallest vertically-stacked full color micro-LEDs, world's best multiferroic devices, battery-less wireless e-skin, and heat dissipating system GaN power devices.

Biography

Prof. Jeehwan Kim is a tenured faculty at MIT. His research group's focuses on material innovations for next generation computing and electronics. Prof. Kim joined MIT in September 2015. Before joining MIT, he was a Research Staff Member at IBM T.J. Watson Research Center in Yorktown Heights, NY since 2008 right after his Ph.D. He worked on next generation CMOS and energy materials/devices at IBM. Prof. Kim is a recipient of 20 IBM high value invention achievement awards. In 2012, he was appointed a "Master Inventor" of IBM in recognition of his active intellectual property generation and commercialization of his research. After joining MIT, he continuously worked nanotechnology for advanced electronics/photonics. As its recognition, he received LAM Research foundation Award, IBM Faculty Award, DARPA Young Faculty Award, and DARPA Director's Fellowship. He is an inventor of > 200 issued/pending US patents and an author of > 50 articles in peer-reviewed journals. He currently serves as Associate Editor of *Science Advances*, AAAS. He received his B.S. from Hongik University, his M.S. from Seoul National University, and his Ph.D. from UCLA, all of them in Materials Science.