MECHANICAL ENGINEERING SEMINAR

Title : ***Material strategies for memristor-based AI hardware and their heterointegration***

Speaker : Prof. Jeehwan Kim (MIT)

Time : 2021-11-23 (Tue) 11:00 AM – 12:00 PM

Zoom meeting ID : *873 9838 2333* (https://snu-ac-kr.zoom.us/j/87398382333)

Abstract : Conventional memristors typically utilize a defective amorphous solid as a switching medium for defect-mediated formation of conducting filaments. However, the imperfection of the switching medium also causes stochastic filament formation leading to spatial and temporal variation of the devices. In this talk, I will present our material strategy to precisely confine the conducting paths in memristors which allow us to operate 1R-based crossbar arrays with a great programmability[1][2]. By embedding this crossbar array into the edge of heterogeneously integrated chip, we demonstrate a reconfigurable heterochips with stackability. The reconfigurable chip features (1) memristor crossbar arrays for non-von Neumann computing and (2) optical communication between chips enabled by heterointegrating LEDs and photodiodes[3]. I will discuss about outlook of our recent reconfigurable heterogeneous integration schemes for future electronics. Material strategies for robust 1R neuromorphic computing array by confinement strategy and its application for reconfigurable edge computing

[1] Shinhyun Choi, Jeehwan Kim*, et. al.*, “SiGe epitaxial memory for neuromorphic computing with reproducible high performance based on engineered dislocations”. *Nature Materials*, Vol. 17, 335–340 (2018)
[2] Hanwoo Yeon, Jeehwan Kim*, et. al.*, “Alloying conducting channels for reliable neuromorphic computing”, *Nature Nanotechnology*, Vol. 15, 574–579 (2020)
[3] Chanyeol Choi, Jeehwan Kim *et. al.*, “Reconfigurable heterogeneous integration enabled by stackable chips with embedded artificial intelligence”, *to be submitted*

Bio : Prof. Jeehwan Kim is an Associate Professor in the Mechanical engineering, Materials Science and Engineering, and Research Laboratory of Electronics at MIT. Prof. Kim's group focuses on innovation in nanotechnology for next generation computing and electronics. Before joining MIT in 2015, he was a Research Staff Member at IBM T. J. Watson Research Center in Yorktown Heights, NY since 2008. Many of his patents have been licensed for commercialization. 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. He is a recipient of DARPA Young Faculty Award. He is an inventor of 200 issued/pending US patents and an author of 50 articles in peer-reviewed journals. He received his B.S. from Hongik University, his M.S. from Seoul National University, and his Ph.D. from UCLA in 2008.

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