

## **Material Strategies for Memristor-based AI Hardware and their Heterointegration**

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**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. 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. I will discuss about outlook of our recent reconfigurable heterogeneous integration schemes for future electronics.

**Jeehwan Kim** is an Associate Professor of Massachusetts Institute of Technology in the Mechanical engineering and Materials Science and Engineering. He is a Principal Investigator in 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 and DARPA director's award. He is an inventor of 300 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, all of them in Materials Science.