Integration of hafnium oxide based ReRAM with CMOS for neuromorphic computing applications

Nathaniel C. Cady

Professor

Colleges of Nanoscale Science & Engineering

SUNY Polytechnic Institute

Neuromorphic computing systems can achieve learning and adaptation in both software and hardware. The human brain achieves these functions via modulation of synaptic connections between neurons. Memristors, which can be implemented as resistive random access memory (RRAM), are a novel form of non-volatile memory expected to replace a variety of current memory technologies and enabling the design of new circuit architectures. These devices are a prime candidate for so-called “synaptic devices” to be used in neuromorphic hardware implementations. A variety of challenges persist, however, for integrating memristors with CMOS, as well as for tuning device electrical performance. My research group has developed a fully CMOS-compatible integration strategy for RRAM-based memristors on a 300mm wafer platform, which can be implemented in both front end of the line (FEOL) and back end of the line (BEOL) configurations. With regard to memristor performance, we are focusing on strategies to reduce stochastic behavior during both binary and analog device switching. This is a key metric for neuromorphic applications, as variability in device conductance state directly influences the ultimate number of levels (weights) that can be implemented per synapse.

Bio:

Prof. Nathaniel Cady received his BA and PhD from Cornell University and has been a professor at SUNY Polytechnic Institute (in Albany, NY) sine 2006. His research spans the fields of biology and biosensors to nanoelectronics. His current work includes development of biosensors for Lyme disease diagnosis and nanoelectronics hardware for neuromorphic systems.