

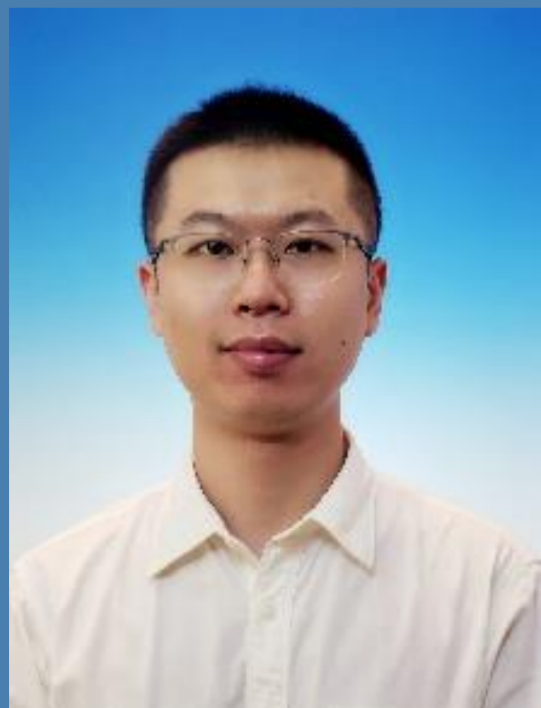
Back-End-of-Line Compatible Oxide Electronics: Advancing Integrated Microchips for Artificial Intelligence

Time: Fri. 9:00 – 10:00 am, June 14, 2024
Venue: Tencent Meeting 687-728-938
Speaker: Dr. Sunbin Deng, Georgia Institute of Technology (GaTech)
Host: Prof. Yuanjing Lin

Abstract:

With zettabyte-scale data generated annually, artificial intelligence (AI) demands rapid increases in computing performance. However, data communication remains the primary bottleneck for system performance scaling. Boosting data transfer bandwidth through monolithic three-dimensional (M3D) integration and alleviating data transfer workload via brain-inspired computing paradigms are promising solutions. In this talk, I will present my recent work on back-end-of-line (BEOL)-compatible oxide electronics, which play a pivotal role in these solutions: (1) To tackle the critical challenge of reliability in amorphous oxide semiconductor (AOS) transistors, a prevalent BEOL-compatible active device option in M3D ICs, I have developed a cost-effective fluorination-in-packaging technique that could efficiently repair oxygen defects at a low thermal budget. (2) Given the inefficiency of off-chip voltage conversion in 3D ICs, I have developed AOS power transistor technology and experimentally demonstrated BEOL-compatible DC-DC converters for efficient on-chip voltage conversion. (3) To yield more power-performance-area-cost (PPAC) advantages in brain-inspired computing, I have developed a BEOL-compatible selective-area doping technique with an extremely high concentration in strongly correlated oxides, enabling the monolithic integration of VO_2 -based artificial neurons and synapses for efficient homotypic neuromorphic platforms. These works underscore the significance of BEOL-compatible oxide electronics in advancing M3D integration and brain-inspired computing technologies for AI-oriented microelectronics.

Biography:



Dr. Sunbin Deng is currently a postdoctoral fellow working with Prof. Suman Datta at the Georgia Institute of Technology, USA. His research interests include back-end-of-line (BEOL)-compatible oxide electronics for monolithic three-dimensional (M3D) integration, alternative computing, and information displays. Dr. Deng received his B.Sc. degree in Optical Information Science and Technology from Huazhong University of Science and Technology (HUST) in 2014 and Ph.D. degree in Electronic and Computer Engineering (under the supervision of Prof. Hoi-Sing Kwok) from the Hong Kong University of Science and Technology (HKUST) in 2020. From 2021 to 2022, he was a postdoctoral researcher at Purdue University, West Lafayette, USA, where he studied strongly correlated oxide electronics for neuromorphic and probabilistic computing. To date, Dr. Deng has co-authored over 70 papers in esteemed peer-reviewed journals (such as Sci. Adv., Nat. Commun., Adv. Mater., IEEE EDL, and IEEE T-ED) and top-tier global conferences (such as IEDM and VLSI), along with 1 book chapter and 6 patents. He has received several academic awards, including the Distinguished Paper Award at SID Display Week Symposium 2021 and the Young Leader Award from SID China.