USC Viterbi School of Engineering
Ming Hsieh Department of Electrical Engineering

Ming Hsieh Institute Seminar Series
Ming Hsieh Department of Electrical Engineering

Semiconductors & Microelectronics Technology

How to Store Information Indefinitely using Ions

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Date: Friday, March 1st, 2024
Time: 2:00 – 3:30pm PT
Location: EEB 248

Abstract: Ion-based memory devices including resistive memory and electrochemical memory present promising opportunities for embedded nonvolatile memory, in-memory computing, and neuromorphic computing. Such devices switch resistance states through the electrochemical migration of oxygen vacancies in transition metal oxides. In this talk, we present our recent research on the materials thermodynamics principles that govern ion motion in oxygen-based resistive memory. Using a combination of device measurements, materials characterization, and multiscale physical modeling, we find that oxygen vacancies do not obey Fick's First Law of diffusion as conventionally believed, but instead undergo composition phase separation, which enables diffusion against the concentration gradient. This phase separation is critical to the ability of resistive memory to retain information for long, and potentially indefinite, periods of time. Finally, we utilize this understanding of phase separation in transition metal oxides to engineer exceptionally long retention times in three-terminal electrochemical memory.

Biography: Yiyang Li is an Assistant Professor of Materials Science and Engineering at the University of Michigan, where he conducts research on ionic memory and energy storage. Trained as an electrochemist, he received his PhD at Stanford University in 2016, and was appointed a Harry Truman Fellow at Sandia National Labs. Yiyang received the Intel Rising Star Faculty Award in 2022.

Hosted by Prof. J. Joshua Yang, Prof. Chongwu Zhou, Prof. Stephen Cronin, and Prof. Wei Wu.
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