CHIPS Act : Semiconductor Manufacturing Science and Technologies
Room Ballroom BC - Session CPS+MS-ThP

CHIPS Act: Semiconductor Manufacturing Science and Technologies Poster Session

CPS+MS-ThP-2 Nanostructural Characterization of 3D DRAM by 3D Reconstruction*, **Wenbin Fan**,* Applied Materials

As the continuous scaling of Dynamic Random Access Memory (DRAM) technology, semiconductor industry is evolving from two-dimensional (2D) to three-dimensional (3D) DRAM to provide the massive amounts of memory required for AI applications. 3D DRAM is expected to require advanced processes (deposition, etching and doping capabilities) to shape and form increasingly precise 3D structures across a 300mm wafer. In this work, a methodology for characterizing the nano structure of 3D DRAM to optimize these various processes is introduced as a promising solution to overcome current metrology limitation in semiconductor industry. Virtually reconstruction of 3D DRAM by hundreds of 2D Scanning Electron Microscopy (SEM) images is successfully demonstrated, offering superior detailed 3D nanostructure and extending the traditional SEM or Transmission Electron Microscopy (TEM) capability. Quantitative analysis on the reconstructed 50-pair Si/SiGe multilayers 3D DRAM is presented with excellent results in the measurements of 2D/3D Critical Dimension (CD) and defectivity.

CPS+MS-ThP-3 Summer Program Advancing Robotics and Knowledge in Microelectronics for K-12 (SPARK)*, Parmida Amngostar, Soheyl Faghir Hagh, Alireza Fath, Yi Liu, Ian Cassidy, Swarup Chakraborty, Alexander Hoefer, Lanhjamin Tran, Cooper Duggan, Dryver Huston,* ***Jackson Anderson****, Tian Xia,* University of Vermont

Since global trade disruption highlighted supply chain vulnerabilities, domestic semiconductor manufacturing has emerged as a national priority, as evidenced through passage of the CHIPS and Science Act in 2022. With this boost in spending comes the risk of workforce shortages, with as many as 58% of new jobs at risk of being unfilled [1]. In Vermont, IBM Microelectronics (now GlobalFoundries) have had a continuous presence since 1957, creating a robust ecosystem of semiconductor manufacturing and design expertise, however local workforce challenges remain. While Vermont has a 91.2% high school completion rate, only 57% of those age 18-24 go on to attend an institution of higher education [2]. Traditionally, microelectronics and semiconductor concepts are not covered in the K-12 curriculum, leaving nearly half the population underinformed about a vital employment industry.

In this work we bridge the microelectronics education gap in Vermont through a workshop developed to educate K-12 science teachers, enabling them to more confidently introduce concepts in the classroom and informal settings. The developed workshop was run for the first time in June of 2025 and covered topics such as electrical prototyping, board and integrated circuit design, programming microcontrollers, interfacing with sensors, microelectronics fabrication, and advanced robotics. Activities were developed such that they could be run in a K-12 setting using the kits provided to teachers during the workshop. Materials have been published at the program website for free use [3]. The initial cohort consisted of 13 teachers from across the state whose instructional focus varied from 4th through 12th grade. Feedback from the attendees will be presented, along with learnings and considerations for any others hoping to offer a workshop like this in their jurisdiction.

[1] “Chipping Away” Report, Semiconductor Industry Association. July 2023.

[2] American Community Survey Table S1501, 2023 5-yr estimates. https://data.census.gov/table/ACSST5Y2023.S1501?g=040XX00US50. Accessed 08/2025.

[3] UVM SPARK. https://sites.google.com/view/spark-vtk12/home. Accessed 08/2025

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CPS+MS-ThP-4 Ge and Gesn Photodetectors for Infrared Application: Toward Si-Compatible High Responsivity Devices.*,* ***Q.M. Kamrunnahar****, Yining Liu, Jay Mathews,* University of North Carolina at Charlotte

Silicon photodetectors are crucial for current optoelectronics due to their CMOS compatibility, scalability, and low fabrication cost. Si is suitable for various applications, from imaging to on-chip optical interconnects, for these features. But the native absorption edge at ~1.1 µm has limited the application of Si in the telecom and critical infrared (IR) communication windows. This shortcoming has created the necessity for advanced materials that can extend detection beyond the range of silicon while remaining compatible with large-scale integration. In this case, Germanium (Ge) is a suitable option with its strong absorption up to ~1.55 µm. It has emerged as one of the most promising and widely used materials for telecom-band photonics and electronics. Recently, GeSn has shown its potential at the extended range of 2.5 to 3 µm. The behavior of Ge can be gained as a direct bandgap by adding tin (Sn). Thus, Ge and GeSn-based photodetectors could be strong candidates in the IR region and can replace the highly expensive InGaAs or HgCdTe photodetectors. In this work, we are presenting our current project to fabricate Ge and GeSn based photodetectors which can work in the infrared region. We have successfully fabricated initial devices using standard microfabrication techniques (Photolithography, etching, ebeam evaporation and lift off) and still working to improve the responsivity and detectivity of the photodetectors which is comparable with industry.

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