

ABSTRACT:

Heterogeneous Integration for Photonic Systems: Challenges and Approaches

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The promise of silicon integrated circuits with their electronic or photonic functionality enhanced via heterogeneous integration of non-silicon materials has motivated significant work over many decades in understanding and overcoming the barriers to realizing such an IC. High-speed electronic devices, devices with high breakdown voltages, light emitting/detecting devices, and devices for photon control could all be integrated with conventional CMOS to perform specialized electronic or photonic functions if suitable methods for forming such heterogeneously integrated regions were available that could overcome manufacturing challenges and reliability issues at scale. Technical challenges include lattice mismatch, thermal expansion coefficient differences, having the capability to form low-resistance electrical contacts using materials that are compatible with CMOS, managing cross-contamination in tools used for front-end-of-line processing after III V regions are established on the silicon wafers, and thermal management for the heterogeneously integrated devices or circuits. In this talk, various approaches for heterogeneous integration will be reviewed, challenges will be discussed, and more recent methods and results will be presented.