SYSTEM ON A CHIP

Electronics and photonics get it together

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Credit: Amir Atabaki

Combining electronics and photonics is a powerful approach to building novel technologies and could, for example, be used to create low-power and efficient computing systems. However, integrating electronic and photonic devices on a single chip is challenging because the complementary metal–oxide–semiconductor (CMOS) technology that dominates the microelectronics industry is based on bulk silicon substrates, and silicon-based photonics typically demands silicon-on-insulator substrates. Amir Atabaki and colleagues have now developed an approach to incorporate photonic devices into bulk silicon CMOS chips.

The researchers — who are based at Massachusetts Institute of Technology, the University of California, Berkeley, the University of Colorado, Boulder, Boston University, and the SUNY Polytechnic Institute — created a photonics platform in

which silicon oxide islands are fabricated in the bulk silicon and a layer of polycrystalline silicon is deposited on top of them. These structures can be used to build photonic components such as waveguides, modulators and photodetectors, which sit alongside transistors fabricated in the standard silicon regions of the chip. The photonics platform was, in particular, integrated with a commercial 65-nm-transistor CMOS process and without degrading the performance of the native transistors.

To illustrate the capabilities of their approach, Atabaki and colleagues used the monolithic electronic–photonic system to build optical transceivers that could operate at ten gigabits per second.

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