Lithium niobate photonic integrated circuits for future optical and microwave links

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As global IT traffic continues to grow at double-digit annual rates, the underlining hardware in contemporary optical and wireless networks is facing increasing challenges in the footprint, power consumption and cost. Photonic integrated circuits could address these challenges by simultaneously integrating many optical components on a single photonic chip. Among various photonic material platforms, lithium niobate (LN) is a particularly attractive candidate owing to its strong electro-optic effect, wide transparency window and low optical loss. While LN has been widely deployed in the telecommunications industry for decades, the material has long been perceived as one that cannot be integrated due to difficulties associated with its nanofabrication. In this talk, I will first discuss our efforts in LN device fabrication techniques that have enabled thin-film LN devices and circuits that simultaneously feature sub-wavelength light confinement, low propagation loss and wafer-scale fabrication capability. Based on this platform, we have demonstrated a series of high-performance integrated photonic components, including electro-optic modulators with CMOS-compatible drive voltages [1] and electro-optic bandwidths covering the entire millimeter-wave band [2], ring-assisted Mach-Zehnder modulators with ultrahigh linearity [3], as well as broadband power-efficient frequency-comb generators [4, 5]. The excellent device performances, together with the low optical loss and wafer-scale processes, could enable a variety of applications in future intra- and inter-datacenter optical links, microwave and millimeter-wave photonics, as well as quantum information processing systems.

References

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