Photonic waveguides suppress "crosstalk among neighbors"

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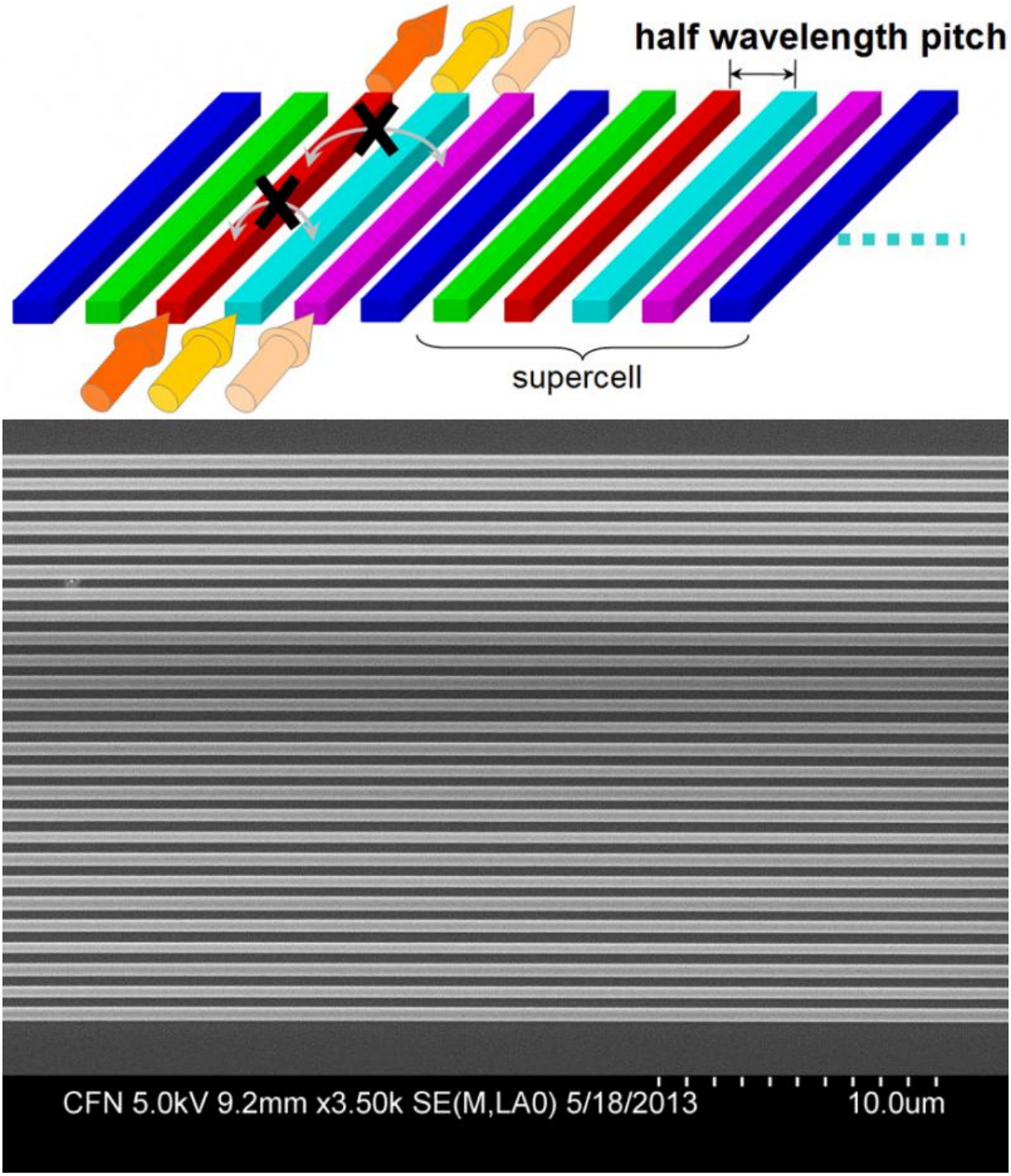

High-density silicon waveguides (26 shown) that have a half-wavelength pitch (a=780nm for λ=1550nm) and fill 50% of the surface area of the underlying substrate have been engineered to achieve inter-waveguide crosstalk below -20dB, paving the way for high-density integrated optical chips.

Silicon photonics holds great promise for low-cost, large-scale integration of photonic components. The demand for increasing density of these components has led to a multitude of technological challenges in their manufacture and operation.

Waveguides are perhaps the most ubiquitous component in silicon photonics. One major obstacle is the amount of crosstalk between adjacent optical waveguides, which is the sum of light in one waveguide coupled from neighboring waveguides. Crosstalk can become profound when the distance between adjacent waveguides is smaller than the wavelength (λ) of the light propagating through them. To address this issue, advanced waveguide superlattices were designed and fabricated, comprising an array of waveguides spaced at a pitch of 0.78 μm (λ/2). Such waveguide superlattices can potentially lead to significant reduction in on-chip estate for waveguide elements and salient enhancement of performance for important applications, opening up possibilities for half-wavelength-pitch optical phased arrays and ultra-dense space-division multiplexing. The detected crosstalk was no larger than -20 dB, a level that confirmed the feasibility of these superlattices in photonic device applications.

This is the first report of the high density integration of silicon waveguides with a half-wavelength pitch. Furhter, low crosstalk was observed for several critical optical communications wavelength bands, such as the 1.505–1.570 μm range, which affords significant opportunities for enhanced optical systems, such as spectrometers and optical-phased arrays.

More information: "High-density waveguide superlattices with low crosstalk." *Nature Communications*. 2015 May 11;6:7027. DOI: 10.1038/ncomms8027

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