Hybrid integration of single quantum dots on silicon photonics chips via transfer printing

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Silicon photonics is a promising approach for large-scale photonic quantum information processing. However, monolithic integration of deterministic sources of single photons on silicon chips remains challenging. In this talk, we review our recent progress in the hybrid integration of quantum-dot single-photon sources on silicon photonics chips. Transfer printing was employed for the hybrid integration processes, in which single quantum dots enclosed in photonic crystal nanocavities were assembled on the chip using pick-and-place processes[1], [2], [3], [4]. This approach enables near-unity coupling of single photons into silicon and silicon nitride waveguides[5]. Moreover, printing transparent electrodes above the quantum dots allows fine electrical tuning of their emission wavelengths[6]. We also investigate alignment-tolerant structures that enable robust coupling between the quantum light sources and silicon waveguides[7], which is important for future large-scale integration.

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