Deterministic transfer of optical-quality carbon nanotubes for atomically defined technology

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When continued device scaling reaches the ultimate limit imposed by atoms, technology based on atomically precise structures is expected to emerge. Device fabrication will then require building blocks with identified atomic arrangements and assembly of the components without contamination. Here we report on a versatile dry transfer technique for deterministic placement of optical-quality carbon nanotubes [1]. Single-crystalline anthracene is used as a medium which readily sublimes by mild heating, leaving behind clean nanotubes and thus enabling bright photoluminescence. We are able to position nanotubes of a desired chirality with a sub-micron accuracy under in-situ optical monitoring, thereby demonstrating deterministic coupling of a nanotube to a photonic crystal nanobeam cavity. A cross junction structure is also designed and constructed by repeating the nanotube transfer, where intertube exciton transfer is observed. Our results represent an important step towards development of devices consisting of atomically precise components and interfaces.

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