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Directed Self-Assembly of Single Quantum Dot Optical Devices[1]

ROBIN WILLIAMS, Institute for Microstructural Sciences, National Research Council, Ottawa, Canada K1A 0R6

Techniques that allow one to control the nucleation site of individual, self-assembled quantum dots are necessary for the fabrication of optical and electronic devices that must align subsequent control structures to the dots. In this talk I will describe a "nanotemplate deposition" technique that allows one to direct the surface migration of deposited Indium species during crystal growth so that InAs quantum dot nucleation sites can be controlled *a-priori* with nanometre precision. Using this technique one can construct high finesse, two-dimensional photonic crystal microcavity membranes in which the optical defect mode is aligned both spectrally and spatially to a single InAs/InP, site-selected quantum dot emitting at 1550nm. I will describe the fabrication and optical characterisation of such cavities, with Purcell factors in excess of 4,000 and mode volumes of approximately $0.5\,(\lambda/n)^3$, and I will illustrate how coupling to these cavities using a tapered nanowire micro-loop fiber can be used to optimize the extraction efficiency for single photon source applications.

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