Multi-wavelength stepping wedge cavity design for a mixed chirality single-walled carbon nanotube film

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A planar microcavity is a well-known photonic structure by sandwiching two distributed-Bragg-reflectors (DBRs). It captures light which can strongly couple with excitons of a gain medium embedded at the anti-node of the cavity. Depending on a specific wavelength of excitons, we can engineer the thickness of the cavity to control the coupling strength, detuning parameters, and other optical properties. Single-walled carbon nanotubes (SWNTs) are an intriguing opto-electronic material for novel photonic applications. In particular, absorption and emission wavelengths can cover UV to NIR spectra depending on the energy band gap associated with the chirality of SWNTs. Due to the limit of the synthesis method, we do not obtain an uniform single chirality SWNT film easily. Rather, we commonly get mixed chirality SWNT films that can generate multiple absorption and emission wavelength peaks. Therefore, we design a stepping wedge microcavity with DBRs where the wavelength of the light from the mixed SWNT film is spatially selected according to the cavity thickness. We perform the numerical simulations to confirm the designs and we are in process of making proof-of-concept devices.