Integrated nano-opto-fluidic platform for nanoparticle characterization in liquid

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Last years have witnessed an increasing interest in the development and active control of the mass transportation at the nanoscale, which has potential applications in many different areas ranging from biological sensors to environmental control. In this sense, photonic crystal sensors have been revealed as very promising candidates due to their versatility, integration capabilities and high sensitivity. The patterning of a periodic air hole array in a dielectric material opens a bandgap in the light propagation through the structure via Bragg reflection. Within this bandgap it is possible to engineering a defect, allowing the confinement of the light at a desired wavelength, which depends on the effective refractive index of the materials. Here, we propose the design of a nanochannel made by the side coupling of two one-dimensional photonic crystal nanobeams. A liquid flowing in between the two nanobeams modifies the effective refractive index of the whole system, consequently shifting the optical resonance. We theoretically demonstrate the high sensitivity of the system to detect refractive index changes (reaching a value of 10^{-6}). This work opens the door for novel applications as the detection of nanoparticles in liquid.

References

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Figures

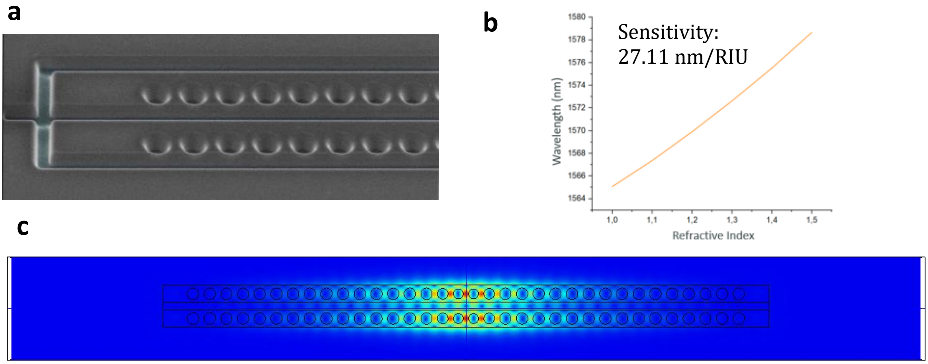

Figure 1: a) Double nanobeam photonic crystal containing channels for liquid sample deposition. (b) Cavity mode's wavelength as a function of refractive index. (c) Double nanobeam simulation of eigenmode.