Design of Optical Directional Couplers Made of Polydimethysiloxane Liquid Crystal Channel Waveguides

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We present numerical simulations of a directional coupler based on three-dimensional waveguides made of a nematic liquid crystal, acting as the waveguide core, infiltrated in polydimethysiloxane channels. Modeling is based on the combination of minimization of Oseen-Frank energy of the liquid crystal molecules with a beam propagation algorithm. Design of the coupler waveguides is optimized to minimize coupling lengths and maximise efficiencies. Such components can be made at low cost on flexible plastic substrates and can be also integrated with optofluidic devices for biomedical applications.

Keywords: Optical waveguides, nematic liquid crystals, optofluidics, directional couplers, optoelectronics.

References:

1. A. d'Alessandro, R. Asquini, M. Trotta, G. Gilardi, R. Beccherelli, and I. C. Khoo, *Appl. Phys. Lett.* **97**, 093302 (2010).
2. G. Gilardi, L. De Sio, R. Beccherelli, R. Asquini, A. d'Alessandro, and C. Umeton, *Opt. Lett.* **36**, 4755 (2011).
3. L. De Sio, M. Romito, M. Giocondo, A. E. Vasdekis, A. De Luca, and C. Umeton, *Lab on a chip* **12**, 3760 (2012).
4. A. d'Alessandro, L. Martini, G. Gilardi, R. Beccherelli, and R. Asquini, *IEEE Photonics Technology Letters*, in print (2015).