Microstructured optical fibers infiltrated with liquid crystals for tunable photonic devices and sensors

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During the last two decades a significant number of experimental studies have been undertaken involving a combination of optical fibers and liquid crystals (LCs).\(^1\)\(^,\)\(^2\) The main driving force behind such experiments is the need to address the growing demand for tunable photonic devices which have a compact and simple design for applications in both optical communications and optical sensing. For example, the evolution of optical communications from point-to-point links to dynamically reconfigurable multi-wavelength networks has resulted in a growing interest in all-fiber modulators, switches, tunable add-drop filters and attenuators. For optical fiber sensing the growing demand for compact and ultrasensitive sensors for environmental monitoring, industrial process control and medical diagnostics drives the search for new materials and technologies for sensing electric, magnetic fields, and bio-chemical measurands.

The most common approaches to the implementation of fiber optic LC devices are either the infiltration of microstructured optical fibers (MOFs) with LCs or by introducing LC claddings to optical fiber structures. We have recently demonstrated a tapered MOF with an LC cladding for sensing of temperature and additionally several tunable devices with applications in optical communications and sensing based on microstructured optical fibers infiltrated with LCs.\(^3\)\(^,\)\(^4\)

In this paper we present our latest research on the microstructured optical fibers infiltrated with liquid crystals and discuss the challenges and opportunities associated with the LC based photonics. In conclusion we present the latest experimental results for a novel microfibre based LC device and discuss future possibilities and developments.

References:

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