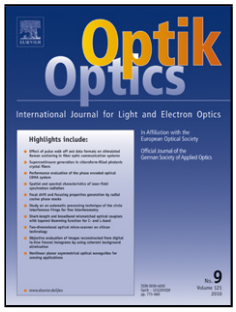

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Simultaneous Measurement of Magnetic Field and Temperature Based on Surface Plasmon Resonance in Twin-Core Photonic Crystal Fiber

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Abstract

Dual-parameter measurement method of magnetic field and temperature based on Surface Plasmon Resonance (SPR) in a twin-core photonic crystal fiber (PCF) is proposed. After platting a silver-graphene layer on the central hole, we infiltrate magnetic fluid (MF) into the hole to manipulate the twin-core structure. Based on the combined use of plasma resonance effect and twin-core PCF, the simultaneous measurement of magnetic field and temperature is achieved by observing the loss-peak shifts appear in output spectra. Moreover, by filling a mixture of chloroform and toluene into the cladding air holes around the right core, not only the temperature sensitivity is improved, but two different sensing mechanisms can be formed simultaneously, so that light propagation in the two cores would not interact with each other. Through dual-parameter demodulation method, the magnetic-field sensitivity and temperature sensitivity can reach up to $0.44\text{nm}/mT$ and $-0.37\text{nm}/℃$, respectively. Such dual-core PCF structure has simple preparation process and good stability, which is applicable to measure multiple environmental parameters.

Keywords: Twin-core photonic crystal fiber; Surface Plasmon Resonance; Magnetic field and temperature measurements; Fiber sensing