Title: Surface plasmon resonance hexagonally structured air-hole fiber voltage sensor

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Abastact: This work proposes a hexagonally structured photonic crystal fiber (PCF) whose center core is filled with the nematic liquid crystal (NLC). The most reliable surface plasmon resonance (SPR) phenomenon is intentionally integrated into the structure by replacing an air hole with a gold wire. The use of metal wire instead of metal film reduces the difficulty associated with attaining uniform film thickness. The finite element method (FEM) is used to analyze and assess the sensor's performance over a broad voltage range of 200 V to 280 V, with a 5 V increment. The sensing performance is observed by varying each structure parameter to achieve the desired performance. However, the wavelength sensitivity (WS) and linearity of the sensor reach up to 6 nm/V and 0.996, respectively. Furthermore, the sensor offers a resolution (R) of 0.0167 V and a figure of merit (FOM) of 33.33 V^{-1} . The proposed sensor offers high performance and a reliable structure, which enables its use in extreme and sophisticated power applications.

K**eywords**: Surface plasmon resonance Photonic crystal fiber Voltage sensor

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