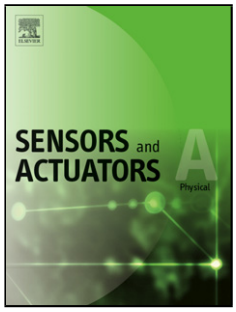

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Electrically Tunable Long Period Gratings Temperature Sensor Based on Liquid Crystal Infiltrated Photonic Crystal Fibers

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Highlights:

- A novel temperature sensor has been proposed based on liquid crystal infiltrated PCF.
- Optimized background material FK51A for PCF to enhance RI sensitivity of infiltrated liquid.
- Optimized sensor obtained narrower FWHM and ultrahigh sensitivity of 481.9 nm/°C (near 58°C).
- Excellent performances have exceeded the reported fiber sensor based on LC infiltration.
- Electrically tunable characteristics provide the potential for the measurement of voltage.

Abstract:

A novel high sensitivity temperature sensor has been proposed and theoretically investigated based on a photonic crystal fiber (PCF) infiltrated with liquid crystal (LC). The LC is infiltrated into the core of PCF, and the refractive index (RI) of LC will be periodically altered due to the electro-optic effect when external voltage is applied on the comb electrodes, which satisfies the formation principle of long period fiber gratings (LPFGs) and thus the attenuation bands can be observed in transmission spectrum. The resonance wavelength is more sensitive to the temperature variations due to incident light interacts with the internal infiltrated LC which has a high thermo-optic coefficient (TOC). Meanwhile, the simulation of theoretical optimization is further carried out in order that the sensor is good performance with narrow full width at half maximum (FWHM) and high sensitivity in the temperature change from 15°C to 58°C. To the best of our knowledge, the sensing performance of temperature variation is superior to previous optical fibers infiltrated by LC material. It is imperative to realize that there is non-linear relationship between the temperature variation and resonant wavelength shift. Nevertheless, the excellent temperature performance that is reliable could be expected to be utilized in the biochemical reaction and cell culture where the high sensitivity measurement within a small