Highly Sensitive Liquid Core Temperature Sensor Based on Multimode Interference Effects.

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Abstract.

A novel fiber optic temperature sensor based on a liquid-core multimode interference device is demonstrated. The advantage of such structure is that the thermo-optic coefficient (TOC) of the liquid is at least one order of magnitude larger than that of silica and this, combined with the fact that the TOC of silica and the liquid have opposite signs, provides a liquid-core multimode fiber (MMF) highly sensitive to temperature. Since the refractive index of the liquid can be easily modified, this allows us to control the modal properties of the liquid-core MMF at will and the sensor sensitivity can be easily tuned by selecting the refractive index of the liquid in the core of the device. The maximum sensitivity measured in our experiments is 20 nm/°C in the low-temperature regime up to 60 °C. To the best of our knowledge, to date, this is the largest sensitivity reported for fiber-based MMI temperature sensors.

Keywords: fiber optic sensor; temperature sensor; multimode interference