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develop a promising sensor that can measure simultaneously tensile strain and temperature, which is an excellent advantage of overcoming the cross-sensitivity problem between tensile strain and temperature in practical sensing applications of smart engineering structures. In other words, tensile strain can be measured via intensity modulation of interference fringe with a high sensitivity of –0.023 dB/με and a measurement range of up to 500 με. And temperature can be measured via wavelength modulation of interference fringe with a very high sensitivity of 51 pm/°C. Therefore, our MZI-based sensor can realize simultaneous measurement of tensile strain and temperature.

It can be found from Figs. 4(b) and 5(b) that the fluctuation of the dip wavelength is less than 0.04 nm while tensile strain is less than 500 με and the fluctuation of the dip intensity is less than 0.028dBm during temperature rise. As a result, the strain-caused error of the dip wavelength and the temperature-caused error of the dip intensity are less than 0.8 °C and less than 1.2 με, respectively, during simultaneous measurement of tensile strain and temperature, which can meet the sensing applications in smart engineering structures.

5. Conclusion

In conclusion, a novel fiber in-line MZI with a misalignment-spliced joint was demonstrated to develop a promising sensor that can realize simultaneous measurement of tensile strain and temperature. The strain and temperature sensitivities of the proposed sensor are –0.023 dB/με and 51pm/°C, respectively. Such a sensor overcomes the cross-sensitivity problem between tensile strain and temperature. Furthermore, our MZI-based sensor exhibits the merits of compact size (only about 8mm), high sensitivities, intensity-modulated for strain, good repeatability and mechanical reliability so that it is a good candidate of next-generation sensors in smart engineering structures.

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