4. Conclusion

We carried out a proof-of-concept demonstration of a discriminative strain/temperature measurement by simultaneous use of the FIR and BGS in an EDF for the first time to the best of our knowledge. The ratio of the fluorescence power at 1565 nm to that at 1530 nm was employed as the FIR in this experiment, which was found to be almost independent of applied strain. Strain and temperature changes estimated by this technique (e.g., 0.09% and 51.0°C) agreed well with the practical values (e.g., 0.10% and 50.0°C). The measurement time is at present not sufficiently short because of the internal scanning function of the OSA, which might be replaced by optical filters and power meters.

The next important challenge is to render this scheme distributed, referring to some techniques proposed to perform distributed Brillouin measurement [1–5]. We have to admit that the FIR distributed measurement cannot be achieved by a simple extension of conventional Brillouin techniques (using backscattered light) because of the following two reasons: (1) the FIR is measured using an OSA with a relatively low sampling rate, and (2) the FIR is measured for transmitted light. To resolve (1), we should acquire the FIR data with a high sampling rate without using an OSA. One implementation would be FIR detection with an oscilloscope after frequency downshift based on optical heterodyne and filtering. To resolve (2), the FIR measurement using not transmitted but reflected light should be explored. The current results presented in this paper, however, indicates that, in a special case where the EDF is uniformly heated (or cooled), strain distribution can be properly discriminated from the temperature information. Thus, we believe that our method is technologically attractive in implementing fiber-optic discriminative strain/temperature sensing systems in future.

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