

Reliability of PMMA-based FBG for humidity sensing

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Abstract: This paper reports the reliability and sensitivity of humidity sensor based on Bragg grating inscribed in polymer optical fibers. Preliminary results show that very good repeatability was achieved after just a few humidity cycles.

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1. Introduction

For the past 2 decades, polymer optical fibers Bragg gratings (POFBG) have been extensively investigated and most of the POFs are based on Polymethylmethacrylate (PMMA). This allows a wide range of core dopant to be added, and a range of fiber designs customized for different sensing applications is possible. Due to their intrinsic properties, PMMA based fibers highly absorb water and such property has been studied in details [1-3].

2. Experimental set up

A polymer optical fiber has been fabricated using the Teflon string method [4] and a 6mm long FBG has been inscribed. Humidity tests were conducted using an environmental chamber with temperature set at 20°C. A programmable humidity profile has been implemented for different humidity levels. The program allowed time for stabilization at the 40%, 60% and 80% levels. Note that the lowest reachable humidity level by the chamber was about 30%. In this study, 10 cycles were executed to investigate the repeatability of the POFBG sensor. Fig. 1 shows the results recorded for the first two cycles and the last two cycles.

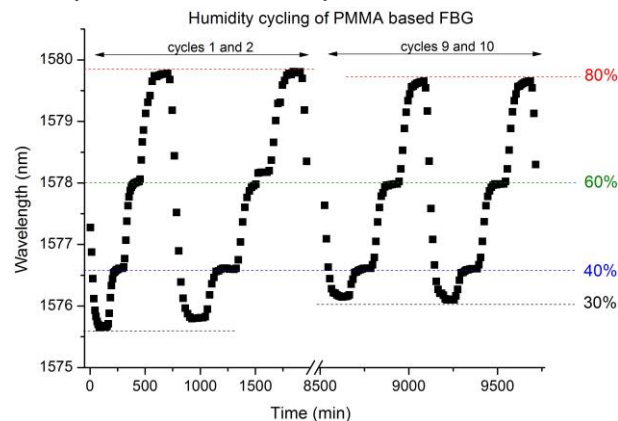


Fig. 1. Humidity cycling of PMMA based FBG

3. Conclusions

The present preliminary work showed that PMMA-based FBG needed a couple of cycles to stabilize and decay in sensitivity has been observed within the first few cycles. This particular humidity sensor exhibits good sensitivity (~70pm/%RH in the last cycle between 40 to 60%RH), and it is reliable after a few cycles. Interestingly, within the range of 40% to 60%, a good repeatability has been observed during all the cycles. Further experiments will be conducted in single mode fibers to investigate if this range can be expanded.

4. References

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