Qufu, China
Aug. 23-27, 2021
ICOCN'2021
The 19th International Conference on Optical Communications & Networks

Fiber optic interferometric humidity sensor by using gelatin

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1. INTRODUCTION

Relative Humidity has an important impact on industrial production and life. Conventional humidity sensors based on electronic technology are hardly used in long-distance and strong electromagnetic-interference environments. Fiber optic humidity sensor has attracted more and more research interest because of their many advantages including compact structure, low weight and free from electromagnetic interference. In this work, we propose and experimentally demonstrate a optic fiber Fabry-Perot interferometer humidity sensor by using gelatin film and hollow core fiber. High sensitivity of 192pm/%RH is achieved within the range of 20-80 %RH, as well as good stability and repeatability.

2. SENSOR DESIGN

A Fabry-Perot interferometer (FPI) was constructed by fusion splicing a hollow core fiber (HCF) with a length of tens of microns at the end of a single-mode fiber (SMF) and coating gelatin film at the free end of the HCF. Relative humidity measurement was achieved by detecting wavelength shift of the interference spectrum.

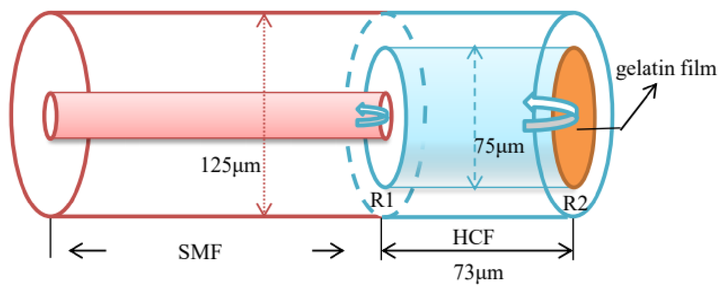

Fig.1. Fabry-Perot interferometer sensing probe schematic diagram

3. EXPERIMENT AND RESULTS

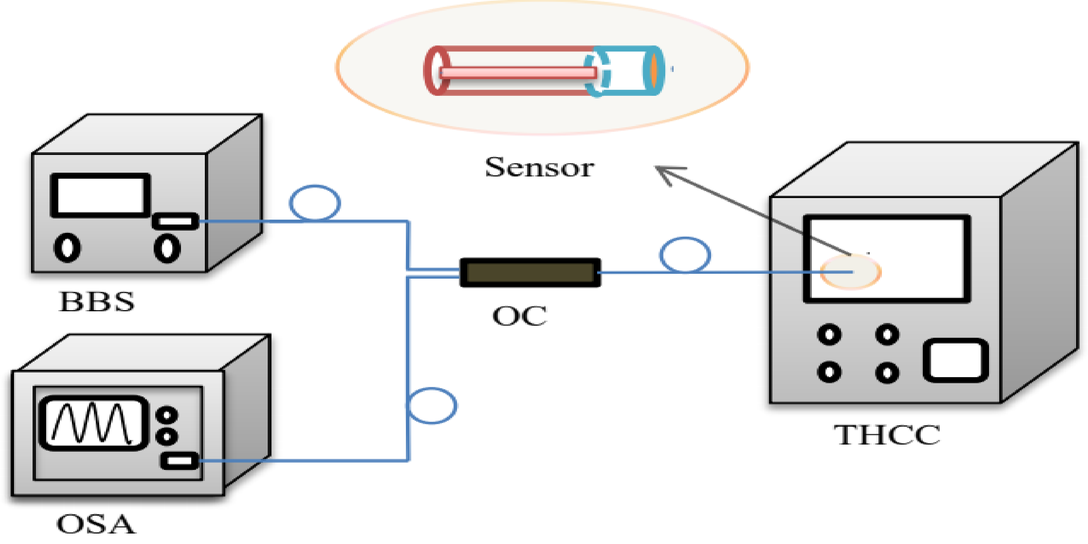

Fig. 2. Experimental setup: BBS, Broadband Source; OSA, Optical Spectrum Analyzers; OC, Optical fiber Circulator; THCC, Temperature and Humidity Control Chamber

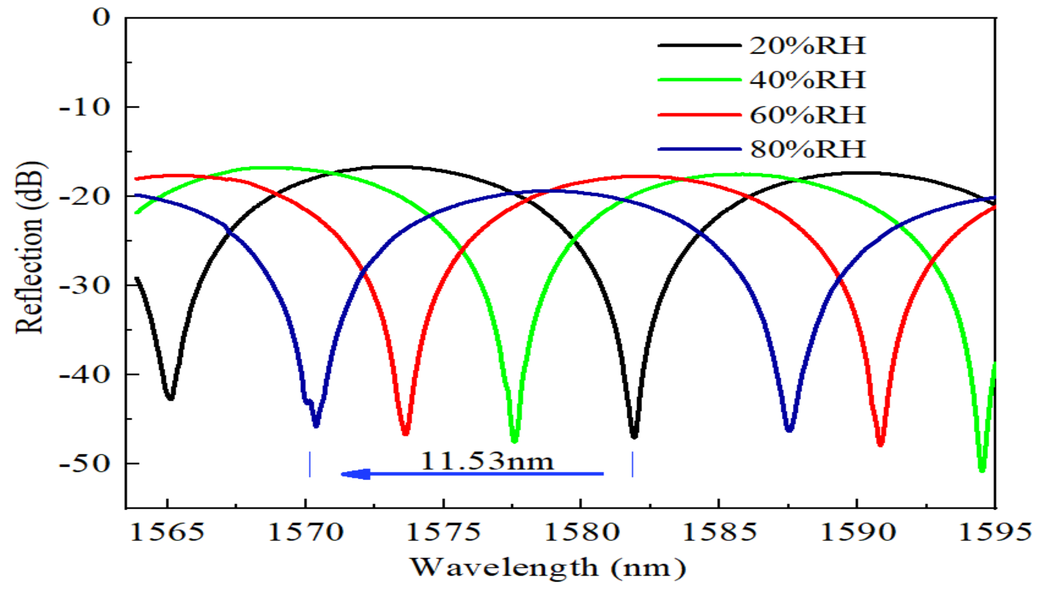

Fig. 3. Spectral variation of FPI sensor under various relative humidity levels.

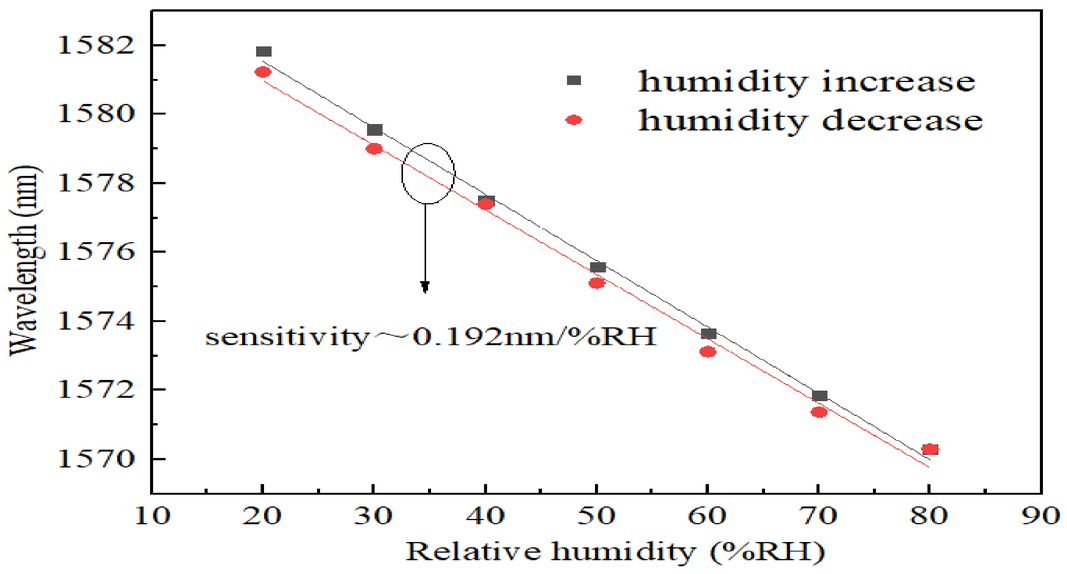

Fig. 4. linear fitting of proposed FPI probe to relative humidity during adsorption and desorption processes.

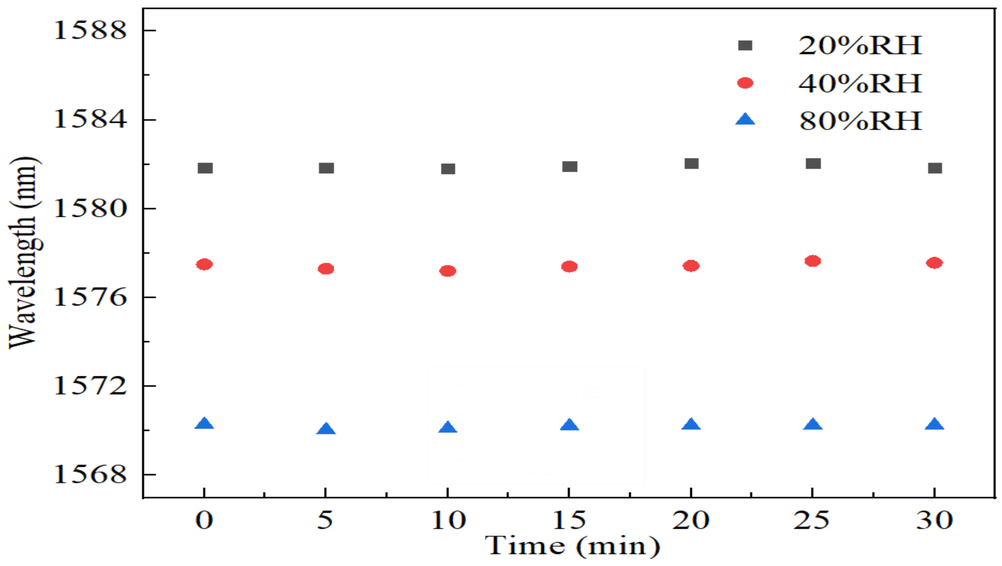

Fig. 5. Stability measurement results of the sensor at different relative humidity

4. CONCLUSION

A FPI fiber optic RH sensor is formed by fusion splicing SMF fiber with HCF and coating gelatin film on the end of HCF. When the RH changes, water molecules absorbed or released by gelatin film and the volume of changes, leading to change of the cavity length and the shift of interference spectrum, which realize the RH sensing. The experimental results show that the sensor has the sensitivity of 192 pm/%RH in the RH range of 20-80 %RH. In Addition, The simple fabrication and good performances make it a potential choice for humidity measurement in biochemical and environmental fields.