



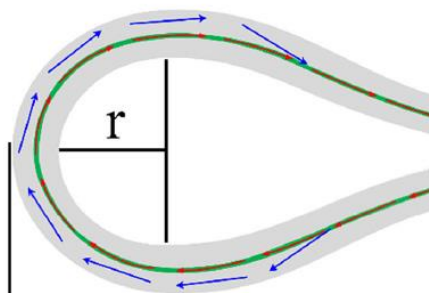
서울시립대학교
UNIVERSITY OF SEOUL

Magnetic Field Sensor Based on Mach-Zehnder interferometer

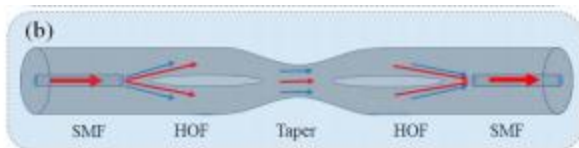
서울시립대학교 전자전기컴퓨터공학부
레이저 및 광반도체 연구실
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Introduction : Mach-Zehnder Interferometer(MZI)

Various kind of MZI



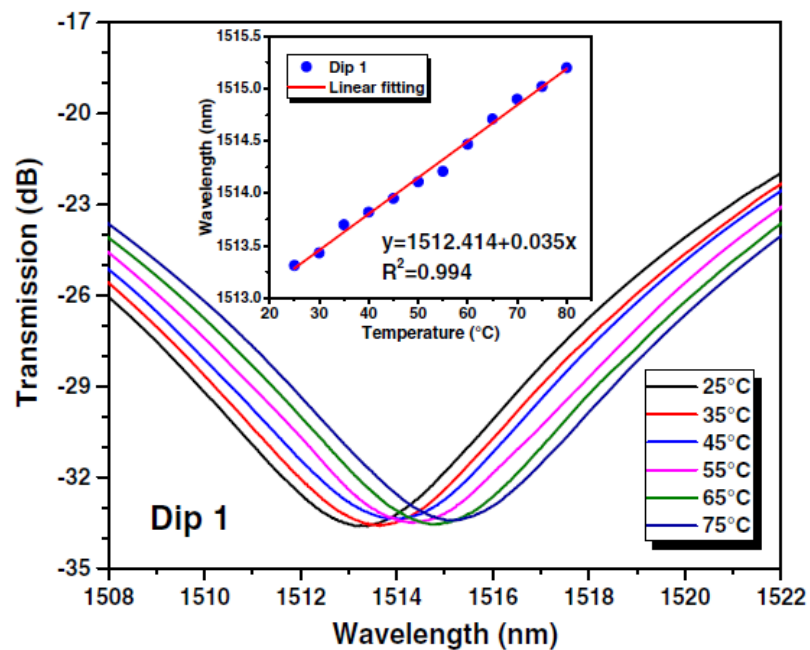
K. Tian, G. Farrell, W. Yang, X. Wang , "Simultaneous Measurement of Displacement and Temperature Based on a Balloon-Shaped Bent SMF Structure Incorporating an LPG," *Journal Of Lightwave Technology*, Vol. 36, 20 (2018)



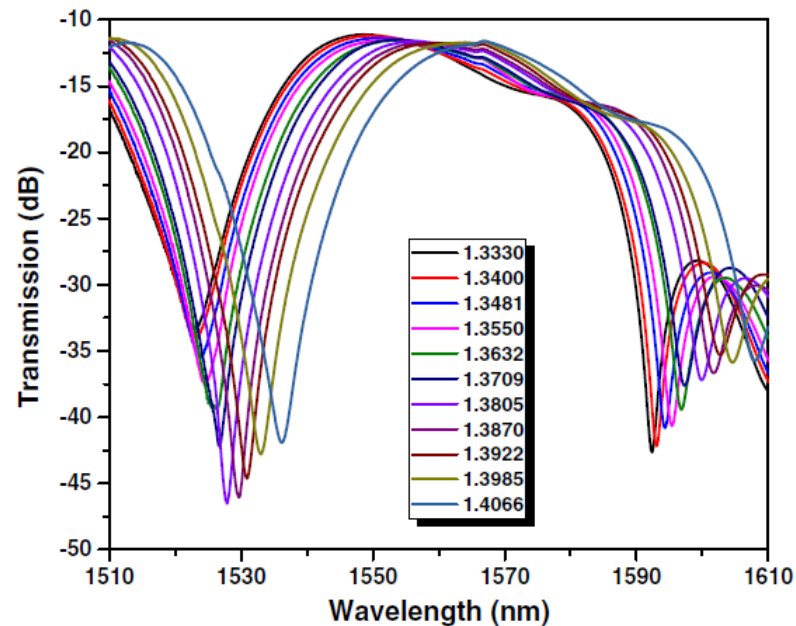
C. Zhu, Y. Yu, X. Zhang, C. Chen, J. Liang, Z. Liu , "Compact Mach-Zehnder Interferometer Based on Tapered Hollow Optical Fiber," *IEEE Photonics Technology*, Vol. 27, 12 (2015)

- Basically, the signal of fiber propagate in the core of fiber.
- There are various kind of MZI based optical fiber sensors.
- The MZI can be generated by bending structure, Single mode fiber – Multi mode fiber – Single mode fiber (SMS)
- When the signal light of the core excited to the cladding region, the interference occurs.

Introduction : Mach-Zehnder Interferometer(MZI)



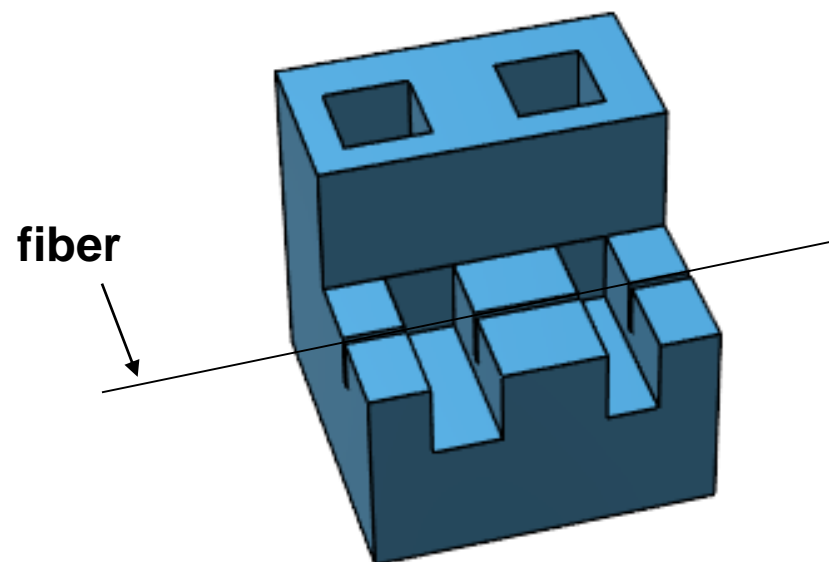
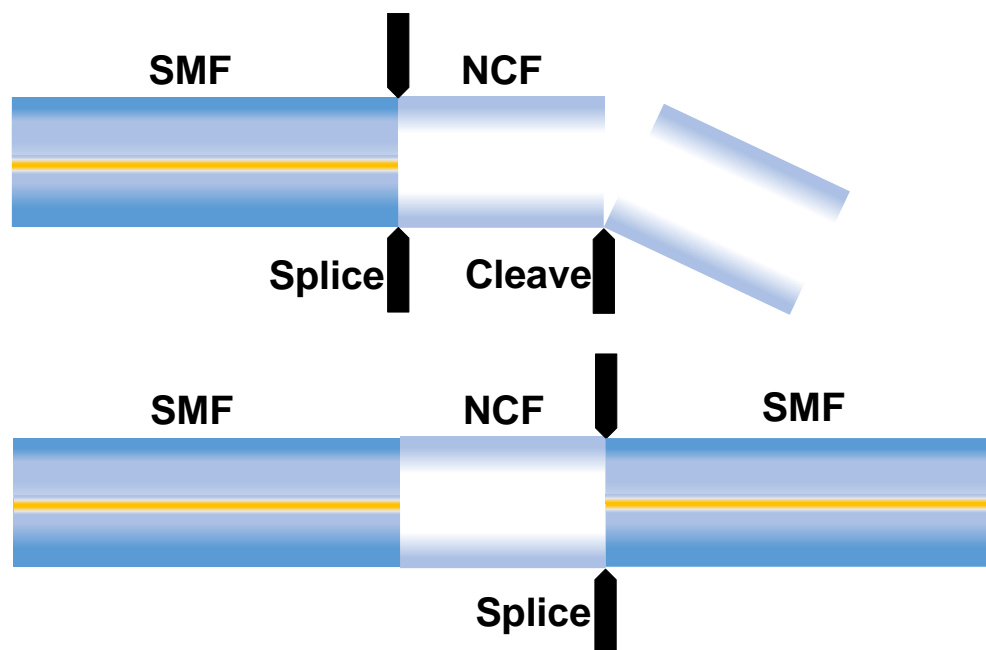
Temperature Sensing



Refractive Index Sensing

Introduction : Magnetic Sensor based on MZI

Fabrication Process of the sensor

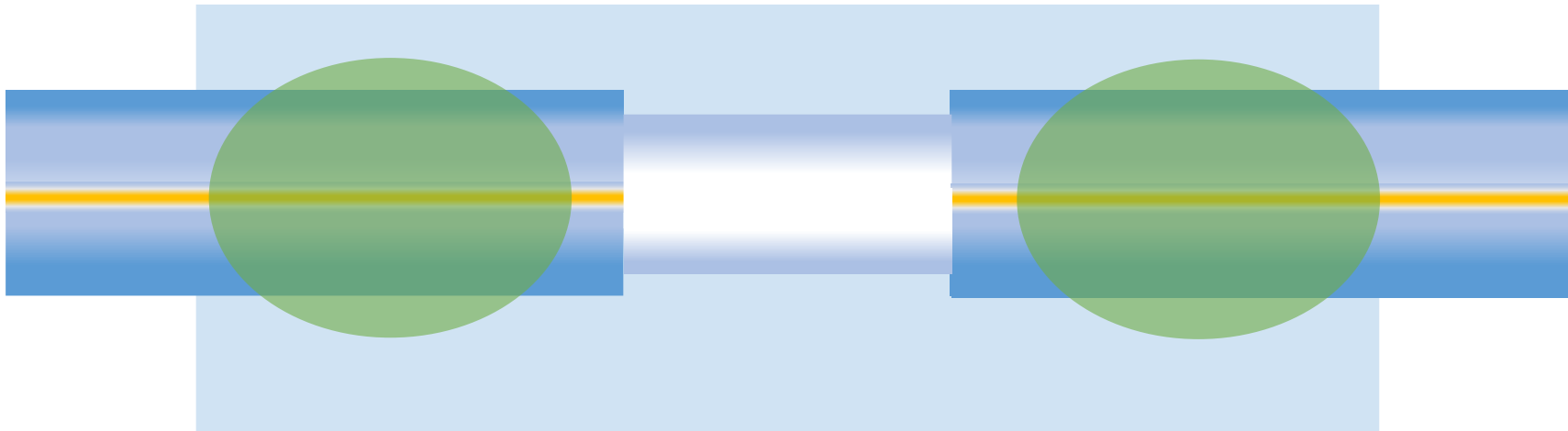


- No-core Fiber (NCF) is spliced between Single-mode Fiber (SMF)

- The spliced sample is etched by 3-D printed cradle

Introduction : Magnetic Sensor based on MZI

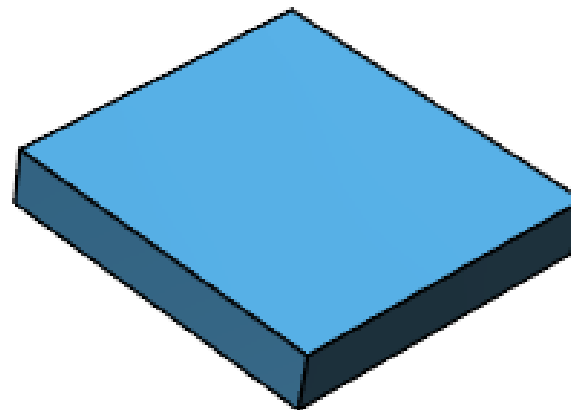
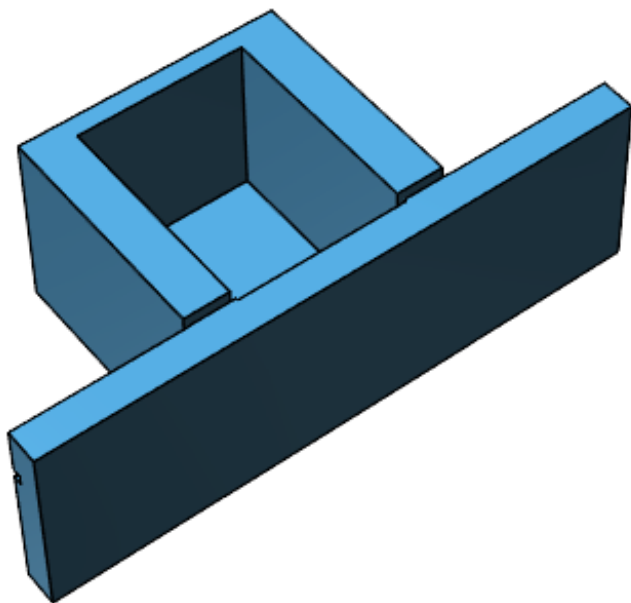
Fabrication Process of the sensor



- The fabricated sample is affixed on the slideglass to test its performance

Introduction : Magnetic Sensor based on MZI

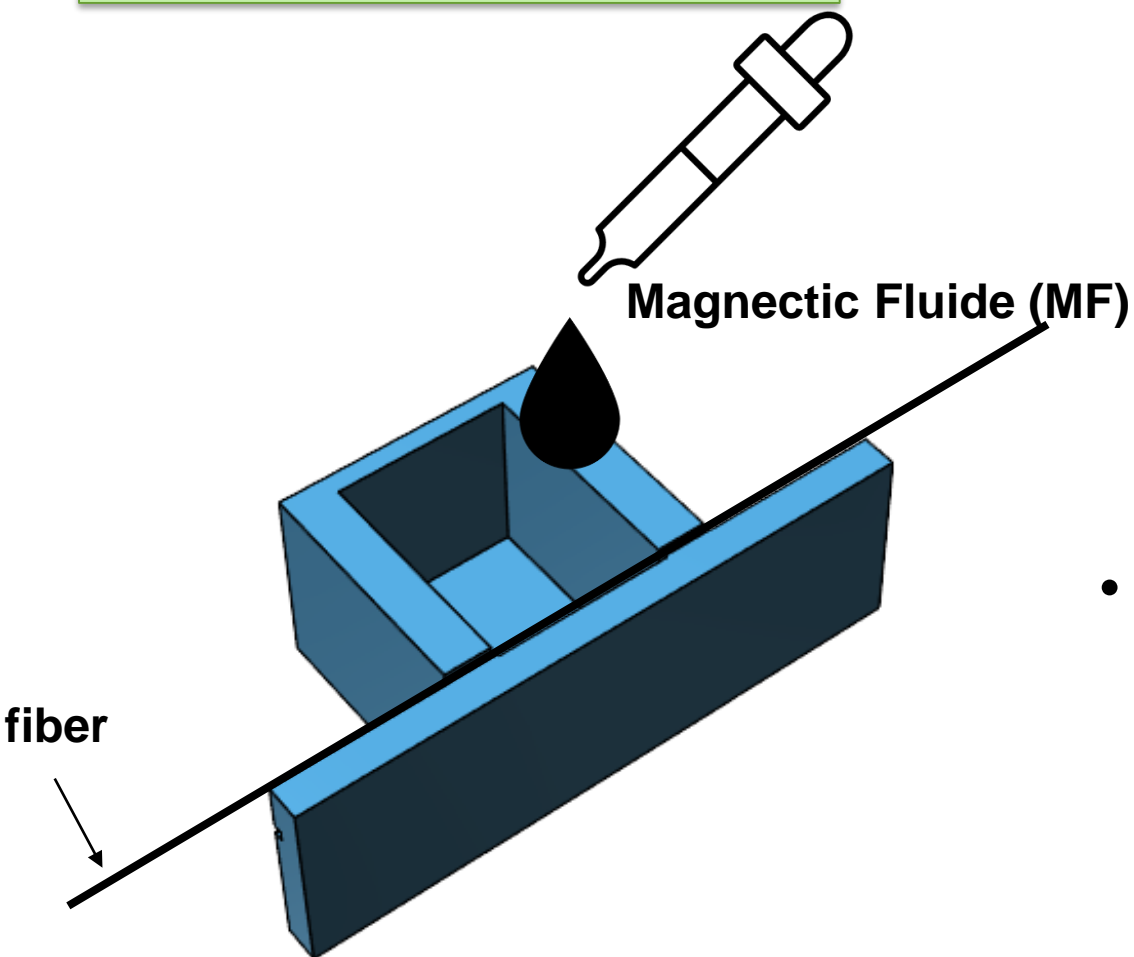
Fabrication Process of the sensor



- Another type of 3-D printed cradle is used to contain magnetic fluid (MF)

Introduction : Magnetic Sensor based on MZI

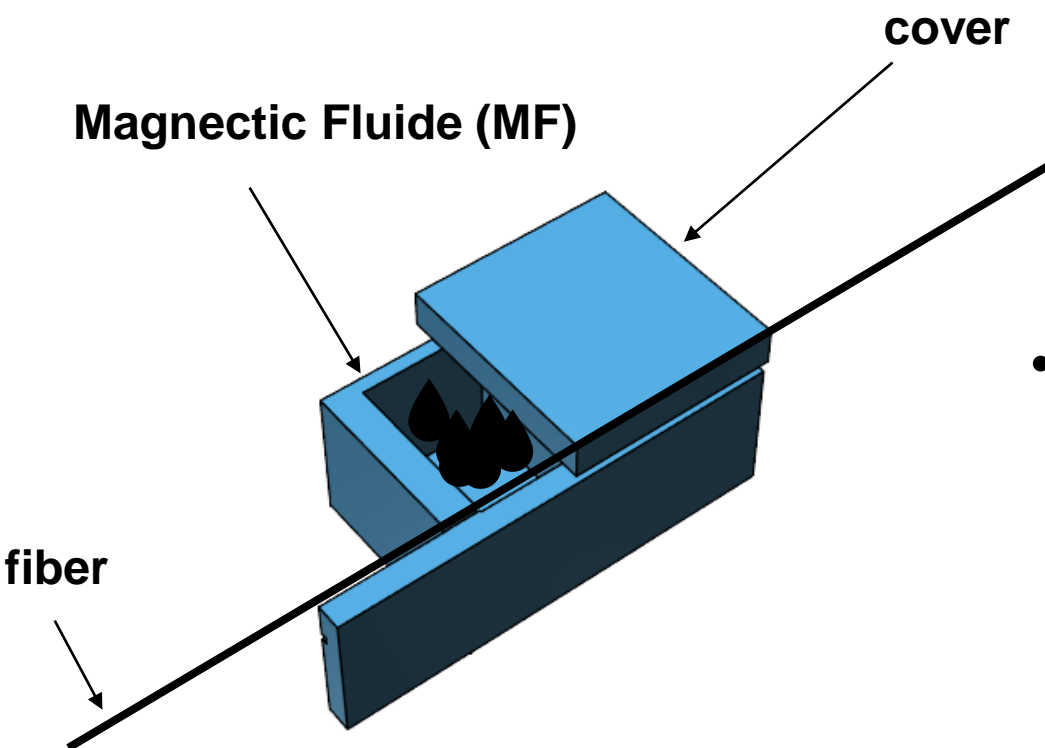
Fabrication Process of the sensor



- After affix the fiber in the 3-D cradle, the empty space of the cradle is filled with MF

Introduction : Magnetic Sensor based on MZI

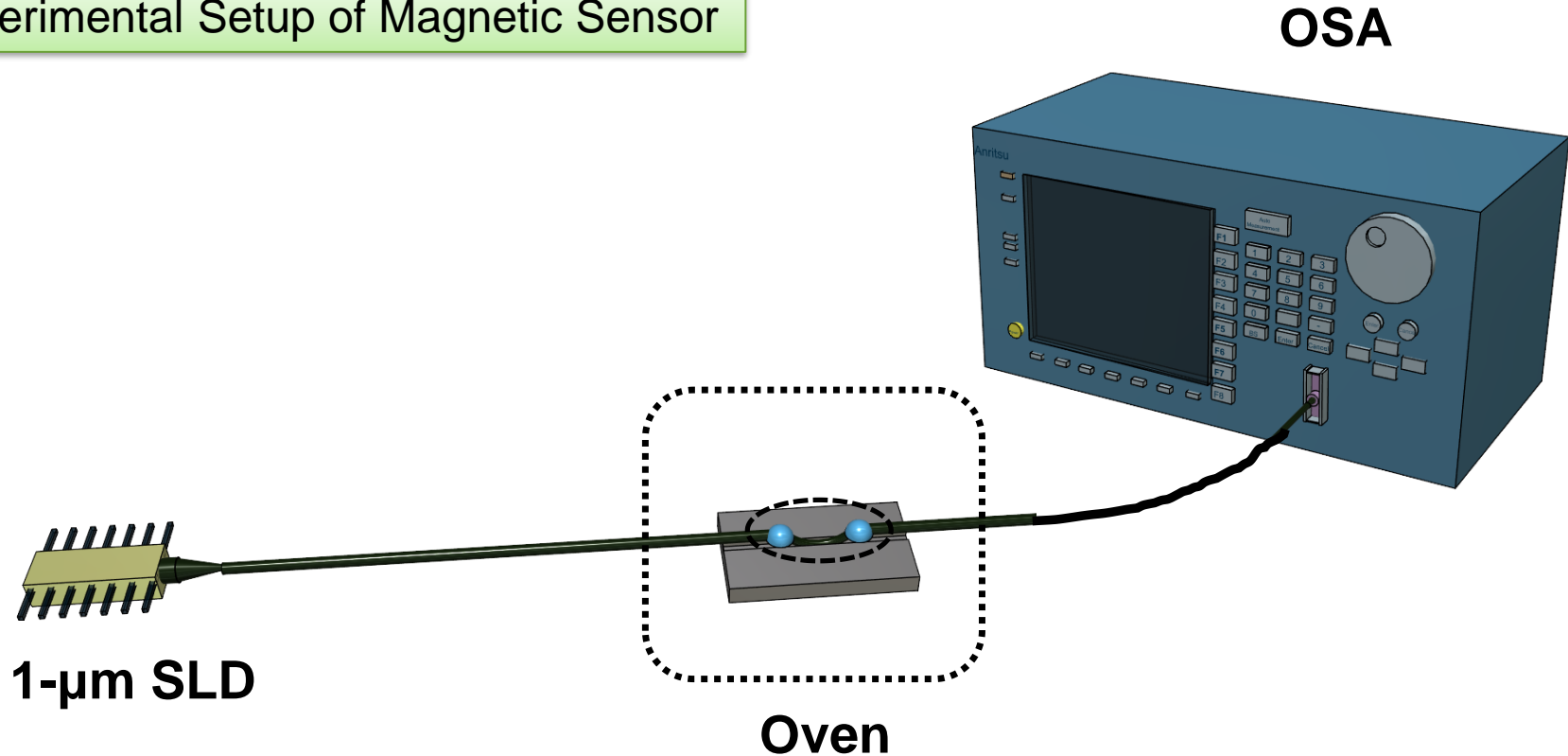
Fabrication Process of the sensor



- After the space is filled with MF, the cover of cradle is used to seal the MF and fiber

Experimental setup

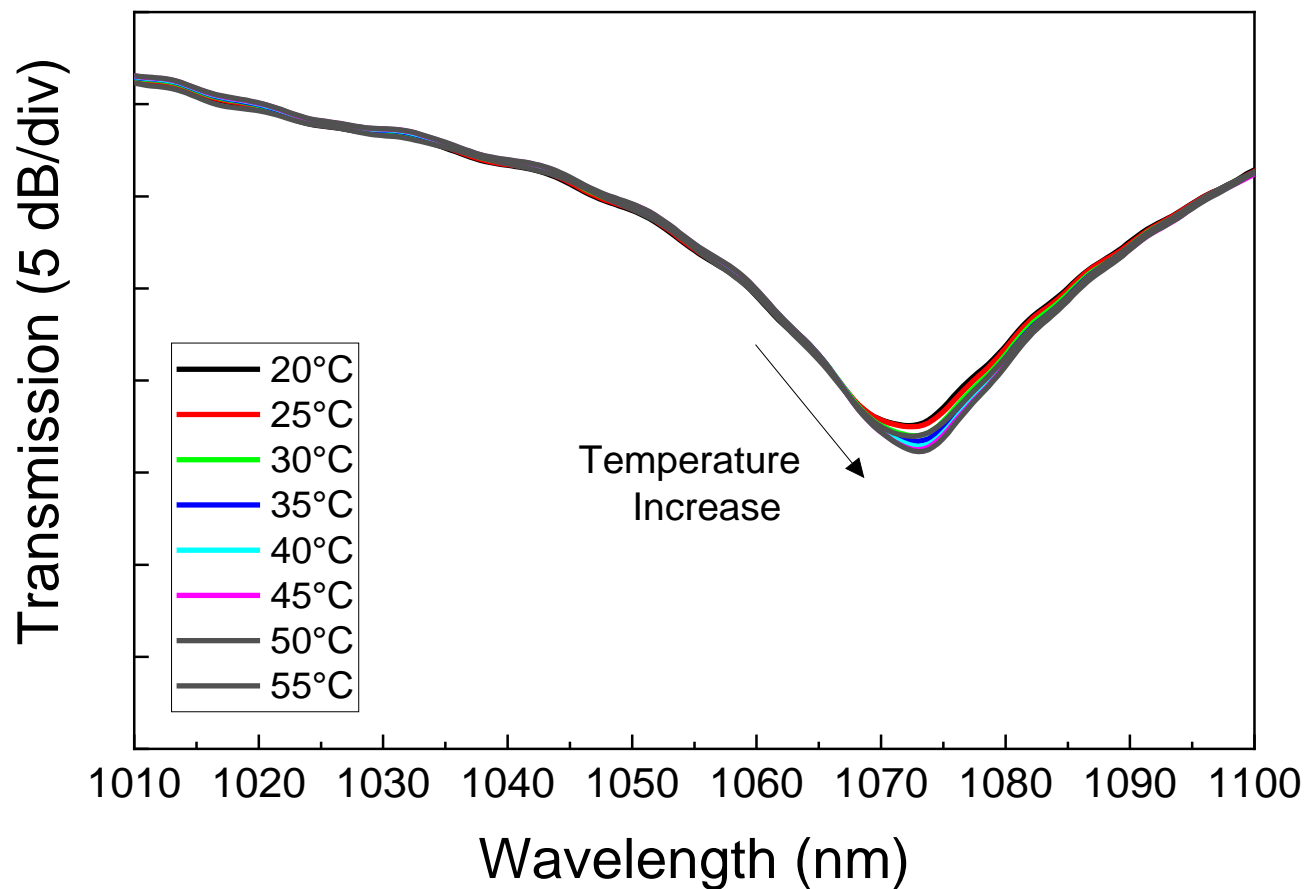
Experimental Setup of Magnetic Sensor



-A super-luminescent diode (SLD, EXS210063-02, Swiss).

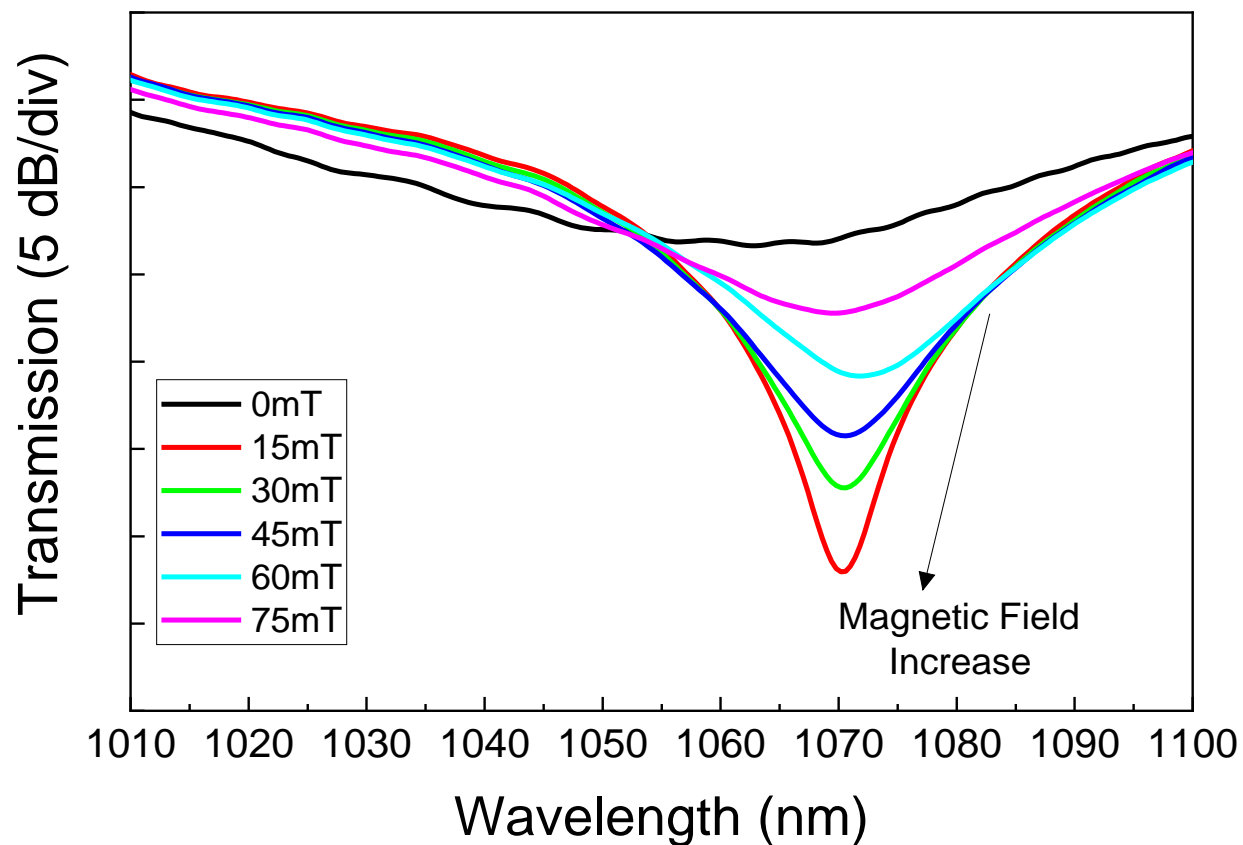
-The output SMF was connected to the optical spectrum analyzer (OSA, Anritsu MS9740A, Japan).

Experimental Results



<Temperature Sensing>

Experimental Results



<Magnetic Sensing>

Conclusion

- The etching-based SNS concatenating structure proposed temperature-insensitive magnetic sensing.
- Using the refractometer configuration with a 4-mm long NCF section, the RI measurement sensitivity of our proposed refractometer is -53.24 nm/RIU. While its temperature sensitivity was 0 pm/°C.
- Our proposed refractometer should prove a good magnetic sensing ability without cross-sensitivity problem.
- Compared to previous temperature-insensitive optical sensor, our proposed sensor has advantaged such as simple configuration, easy fabrication, high-sensitivity.

Thank you for your attention.