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Fibre Optic Sensors

For the monitoring of relative humidity

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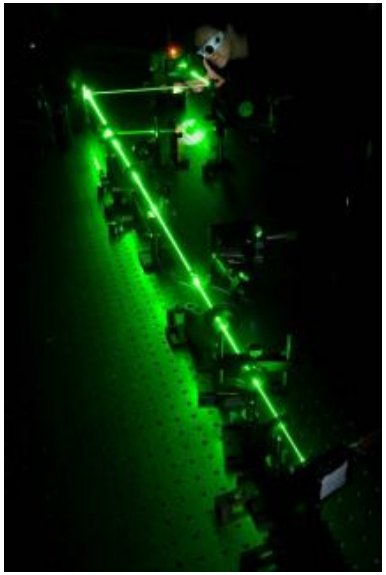
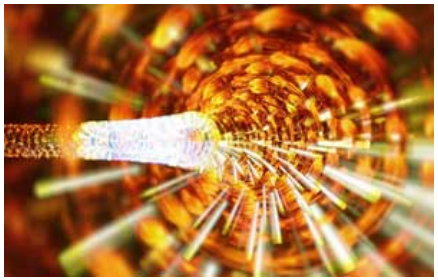
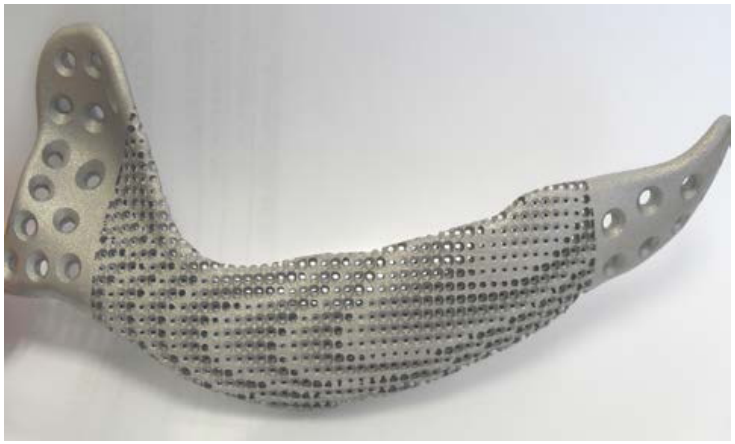
Research and Technical Services

- Advanced Materials Team

Area/Capability
Titanium
Photonic Sensors
Optically active materials
Cement Research
High Temperature Processing/CO_2
Synthetic Chemistry
Coatings
Synchrotron
Ceramics



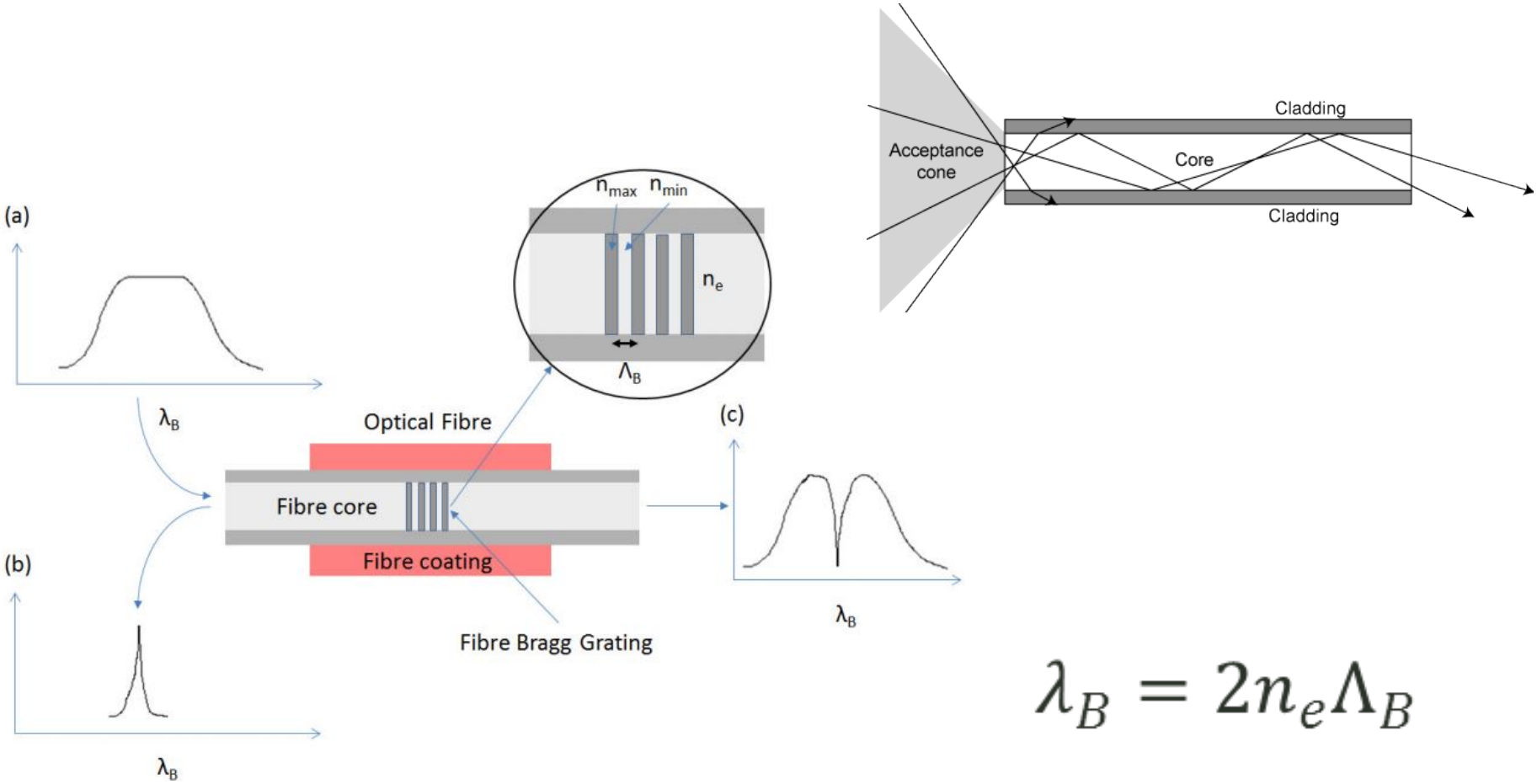




Outline

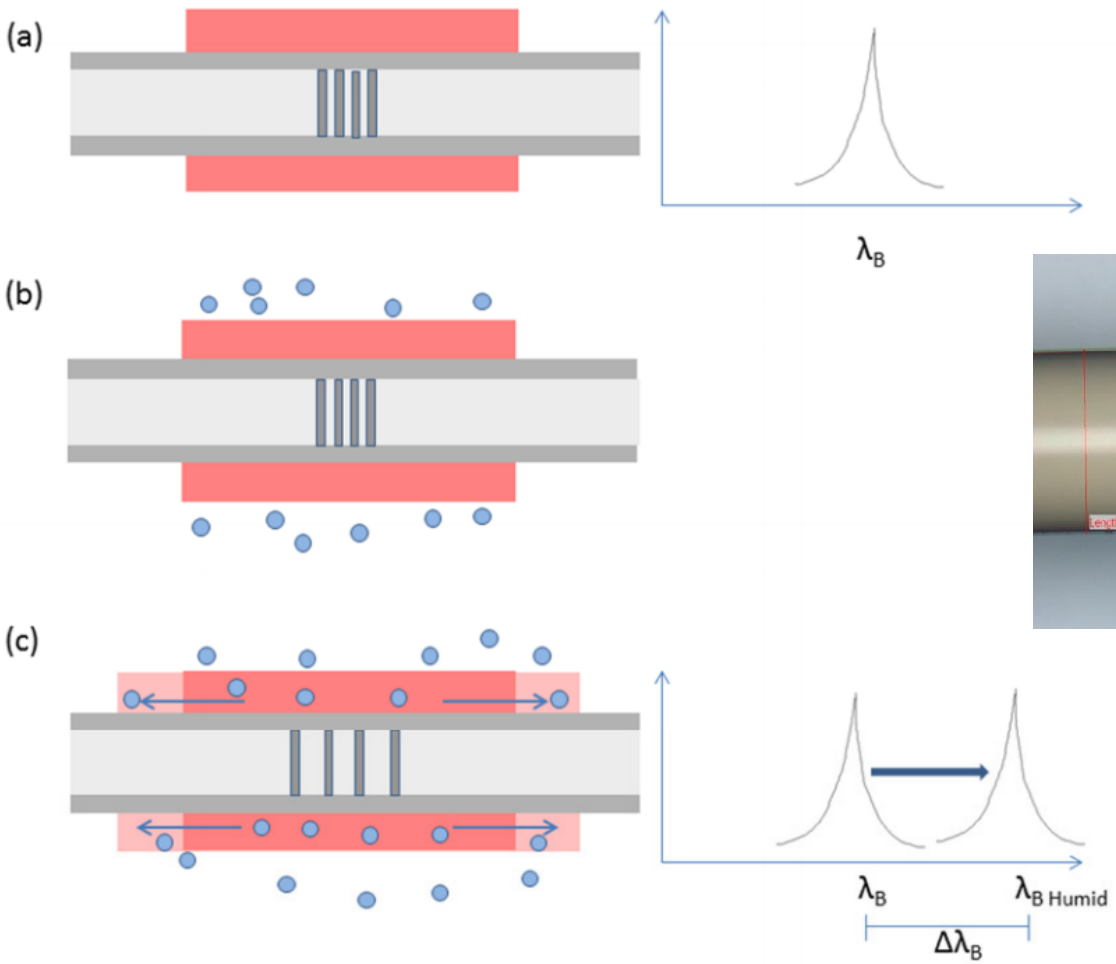
- Fibre Bragg grating fundamentals
- Applications of fibre Bragg gratings
- Coated fibre humidity sensor
- Dye doped polymer film sensor
- Application in structural health monitoring
- Summary

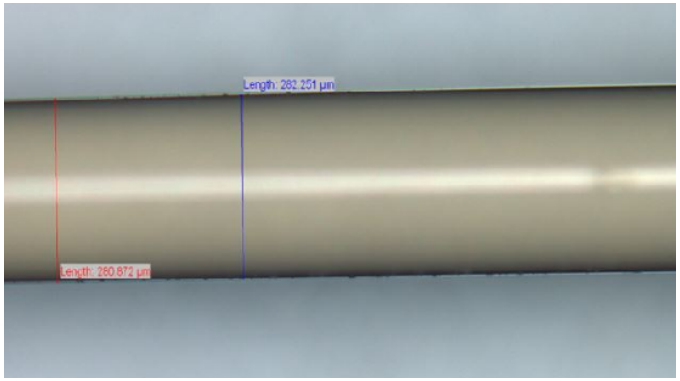
Fibre Bragg grating fundamentals



$$\lambda_B = 2n_e\Lambda_B$$

Fibre Bragg grating fundamentals





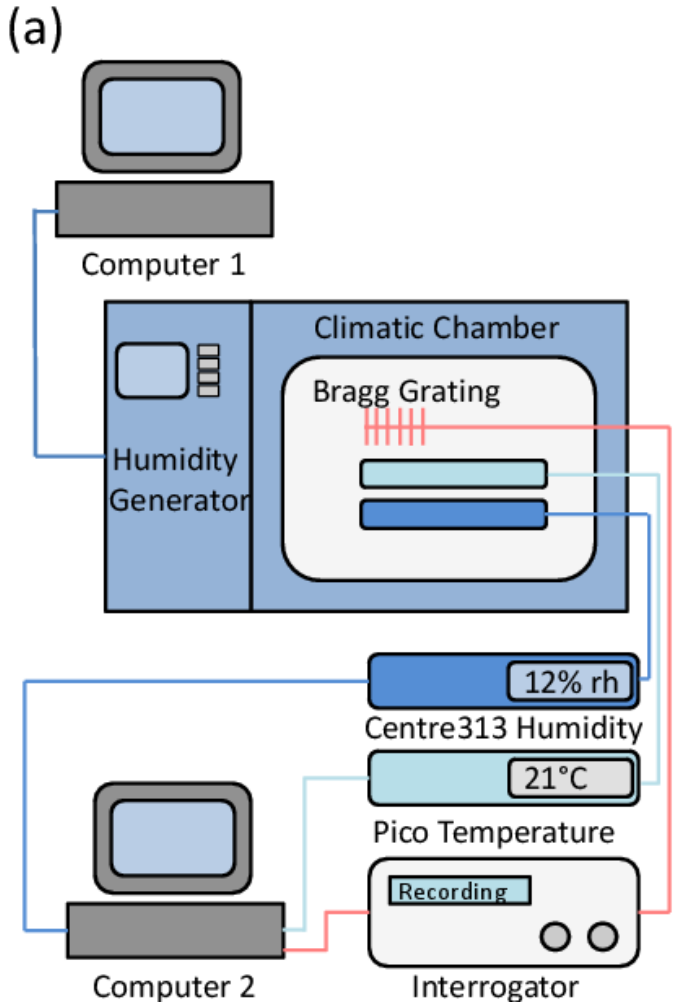
Applications of Fibre Bragg gratings

Fibre Bragg gratings (FBGs) can be used as humidity sensors
- where traditional sensors can not be used

Humidity sensing applications include:

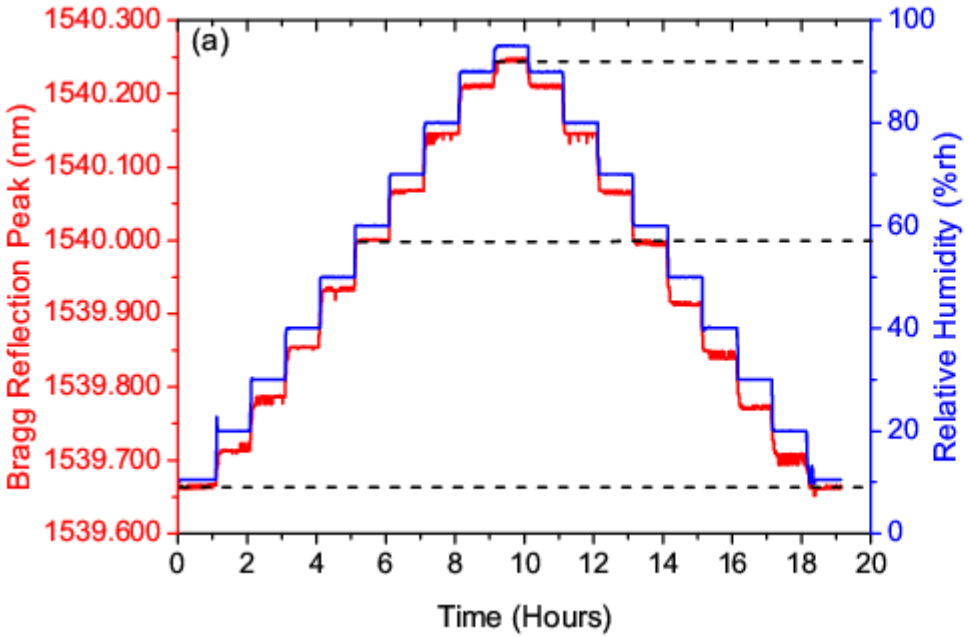
- Structural health monitoring
- Power transformer health monitoring
- Domestic appliances

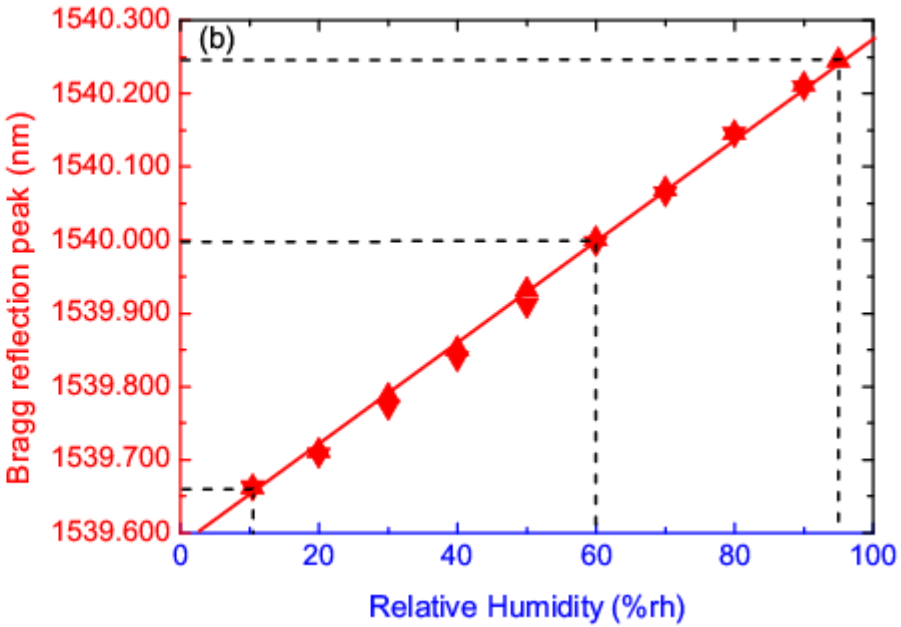
Coated Fibre Humidity Sensor



Coated Fibre Humidity Sensor

Evonik P84 HT



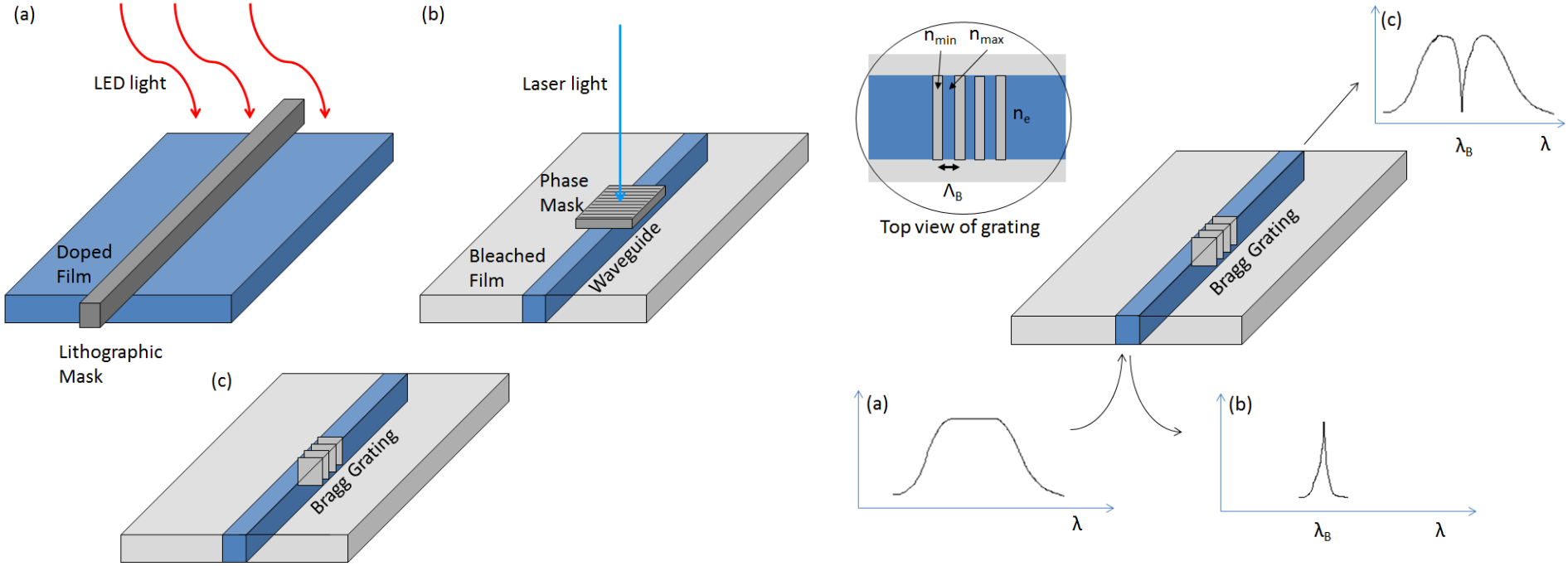


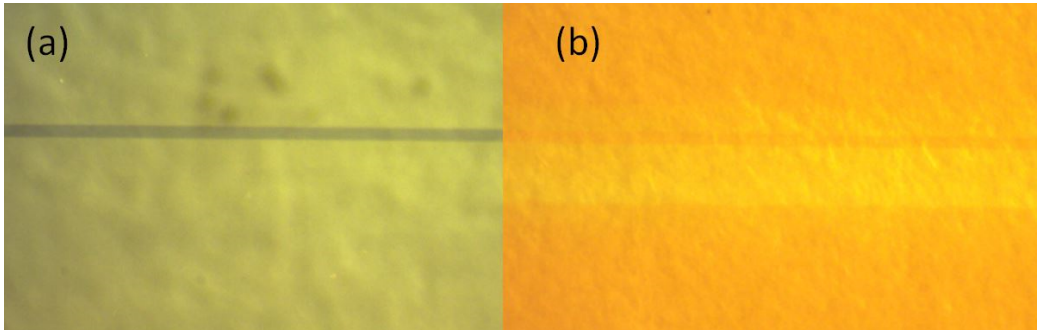
Response slope = 7.20 pm / %rh

CME = 73.8 ppm / %rh

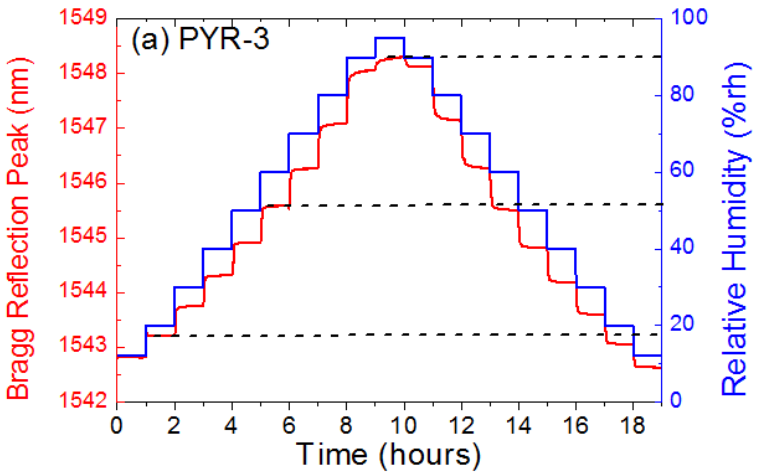
Pyralin PI 2525 CME = 92 ppm / %rh [T.L. Yeo, K.T.V Grattan et al]

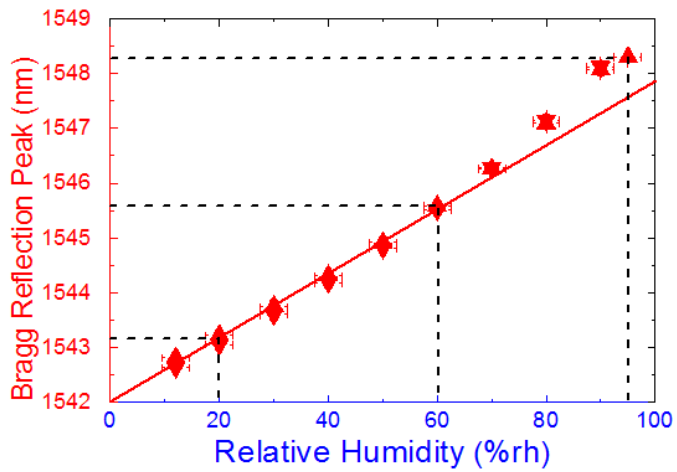
Dye Doped Polymer Film Sensor



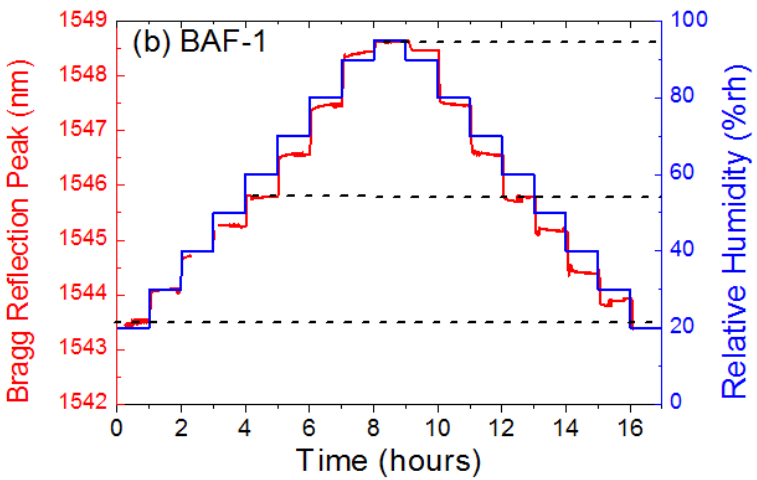


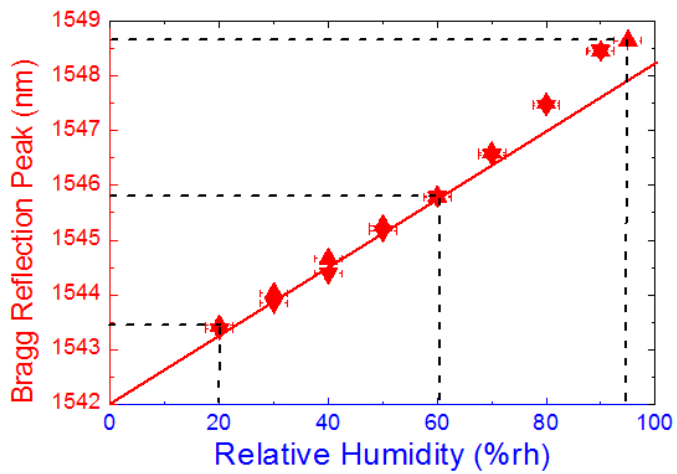
Dye Doped Polymer Film Sensor





Slope (21 µm) = 59.4 pm / %rh





Slope (15 µm) = 62.1 pm / %rh

P84 HT (53 µm) = 7.20 pm / %rh

PMMA (50 µm) = 0.97 pm / %rh

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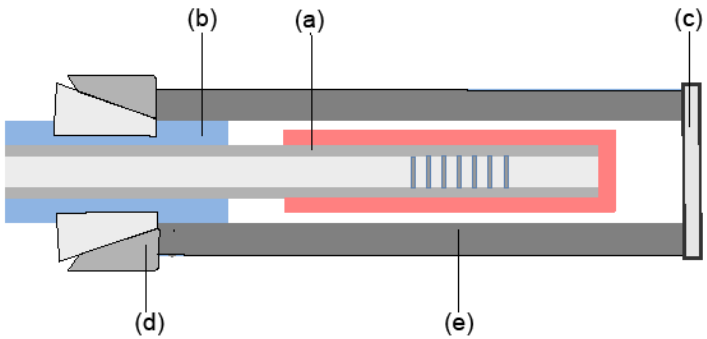
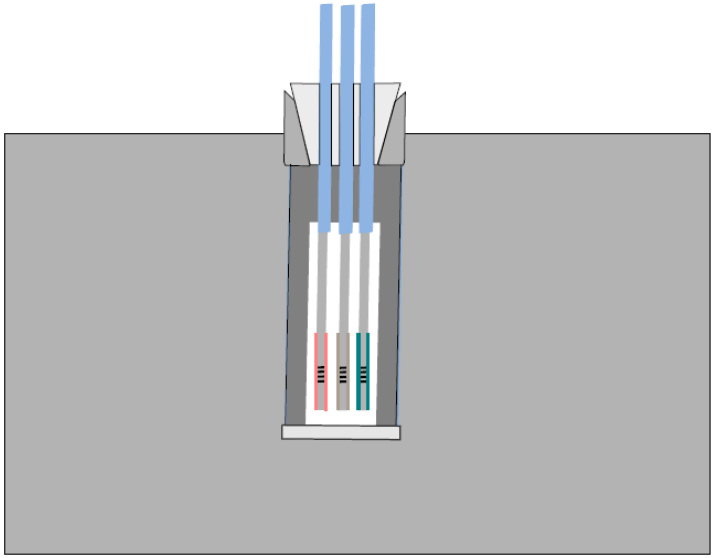
Application in structural health monitoring





(a) Polyimide coated FBG

(b) PEEK tube

(c) Microporous PTFE filter

(d) Swagelok seal with PTFE ferrule

(e) PEEK housing

Summary

- Advantages in using FOS over conventional sensors

- particularly in harsh / compact environments

- We have developed improved sensors
- We have developed modules with multiple sensors for use in concrete monitoring