Fiber Bragg Grating-based Humidity Sensor

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Temperature-compensated FBG Humidity Sensor

The strain effect of a FBG can be functionalized for humidity measurements with a polymer coating layer around the grating surface. Depending upon the moisture induced functional material volume expansion, the mechanical strain could induce central wavelength shift. However, a FBG may respond to both thermal strain and mechanical strain variation in real environment. At constant temperature environment, a standard humidity sensor may not need temperature compensation. If this is not the case, the measured strain response amplitude may also include temperature contribution. To substrate temperature effect from humidity measurement from first FBG sensor, second FBG, acting as a temperature sensor, is also packaged inside the humidity sensor to form an athermal humidity sensor package. Since second FBG measured temperature can be used to deduct first FBG sensor thermal response amplitude, the real strain will be determined by

$$\varepsilon(t) = \kappa(\varepsilon) \cdot [\Delta\lambda(1) - \Delta\lambda(2)]$$

where $\kappa(\varepsilon)$ is strain sensitivity, which varies with coating material thermal expansion properties and thickness of the coating layer.

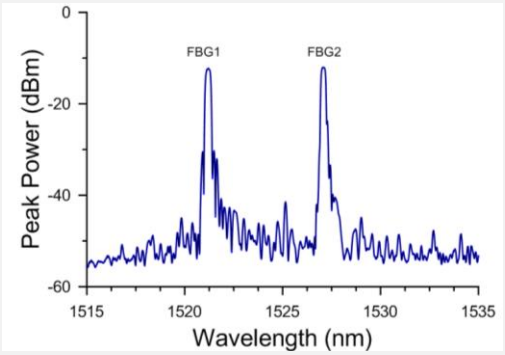

Figure 1 Two FBG sensor Peak power spectra from a temperature-compensated humidity sensor package

FBG Humidity Sensors and Package

In a vibrating application environment, a strain effect based humidity sensor package has to be designed against any dynamic strain change. However, in a radiative environment, the sensor package has to be designed against radiation-hardening effect induced wavelength drifting effect. By considering thermal effect, a real reliable FBG humidity sensor package has to be vibration insensitive, temperature compensated, and radiation insensitive. According to such requirement, BI has designed three kinds of humidity sensor prototypes. First prototype is for standard static environment with only one FBG for humidity measurement. Second prototype is for dynamic environment with two FBGs, one has polymer coating, and the other without coating. The dynamic strain variation could be measured by monitoring its frequency spectrum by Fast Fourier transform. Third prototype is an engineering prototype at this moment, which is similar to second prototype with two FBGs, but a scintillation package material will be used to provide FBGs radiation protection.

FBG humidity Sensors

SPECIFICATIONS:

Parameters	OEFHS-100A	OEFHS-100B
Range (%RH)	10 - 100	
Sensitivity (pm/%RH)	4.5*	
Central Wavelength (nm)	1060, 1300, 1550	
Size (diameter x length), mm	6 x 40 or 3 x 40	6 x 60 or 3 x 60
Temperature Sensor	N. A.	Built in
Fiber Output	Single or double	
Fiber Cable	3mm**	
Operation Temperature (°C)	0 ~ 80**	

*. A higher sensitivity product will be available soon. Please call us for the details.
**. An Armoured fiber cable is also available for temperatures higher than 100 C version product

To meet different demands from industrial and University R&DE, we can customize the fiber humidity sensor and installation package designs. When you place your order, please specify your specific requirements to our sales department at: sales@bostoninstruments.com