



## 低温敏的双管式光纤Bragg光栅应变传感器的研究

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摘要：

机械构件由于荷载会产生应变，根据应变分布情况可以确定构件的强度信息以及所受实际荷载状况。研制了一种降低温度敏感性的双金属管光纤Bragg光栅应变传感器。利用内、外管材料热膨胀系数的差值，抵消光纤Bragg光栅由于热膨胀和光热效应发生的形变，实现在应变测量过程中的温度补偿。内、外管之间采用螺纹结构连接，通过调整内管的螺纹长度来调节传感器的测量范围和温度补偿效果。实验表明，该传感器的温度灵敏系数为 $2.62\text{pm}/^\circ\text{C}$ ，是裸光栅温度灵敏度的25%；应变灵敏系数为 $1.215\text{pm}/\mu\text{e}$ ，非线性误差为0.8%FS，滞后为3.6%FS，重复性误差为2.86%FS。

关键词：应变传感器；低温敏；温度补偿；双金属管；光纤Bragg光栅

## Research of Double Metal Tube Type Fiber Bragg Grating Strain Sensor with Low Temperature Sensitivity

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**Abstract:**

Mechanical components can generate strain due to the load, and the strength and actual loading conditions of components can be determined according to the distribution of strain. A kind of fiber Bragg grating strain sensor with double metal tubes is developed, of which the temperature sensitivity can be lowered. By the difference of thermal expansion coefficient between the inner tube and outer tube, the deformation of the fiber Bragg grating due to thermal expansion and photothermal effect can be offset to achieve temperature compensation in the process of strain measurement. The inner tube and outer tube are connected with the whorl structure, and the whorl length of the inner tube can be changed to adjust the measurement range and temperature compensation effect of the sensor. The experiment indicates that the temperature sensitivity coefficient of the sensor is  $2.62\text{pm}/^\circ\text{C}$ , which is 25% of the bare grating's, the strain sensitivity coefficient is  $1.215\text{pm}/\mu\text{e}$ , the nonlinear error is 0.8% FS, the hysteresis is 3.6% FS, the repeatability error is 2.86% FS.

**Keywords:** strain sensor; low temperature sensitivity; temperature compensation; double metal tubes; fiber Bragg grating

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