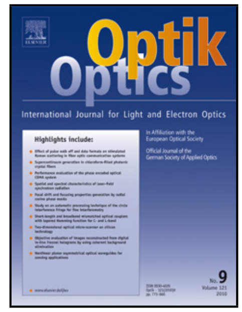
Accepted Manuscript



Title: High-Temperature Sensor Based on Peanut Flat-end Reflection Structure

Authors: Yina Li, Zixin Liang, Chunliu Zhao, Dongning Wang

PII: S0030-4026(17)30907-5
DOI: http://dx.doi.org/doi:10.1016/j.ijleo.2017.08.015
Reference: IJLEO 59478

To appear in:

Received date: 24-5-2017
Revised date: 17-7-2017
Accepted date: 2-8-2017

High-Temperature Sensor Based on Peanut Flat-end Reflection Structure

Yina Li, Zixin Liang, Chunliu Zhao*, Dongning Wang

Yina Li, Chunliu Zhao*, Dongning Wang are with the Institute of Optoelectronic Technology, China Jiliang University, Hangzhou, Zhejiang, 310018, China (e-mail: lia61994@126.com; zhchunliu@hotmail.com; dnwang@cjlu.edu.cn).

Zixin Liang is with the Australian National University, Acton, Canberra, ACT, 2601, Australia(e-mail: zoeliang413@gmail.com).

*Corresponding author : Chunliu Zhao (e-mail: zhchunliu@hotmail.com)

***Abstract*—A high-temperature sensor based on a peanut flat-end reflection structure is demonstrated. The sensor can be simply fabricated by splicing the spherical end-faces of two segments of single-mode fibers and then cleaving one other end as a flat reflect surface. The proposed structure works as a reflected interferometer. When the ambient temperature changes, the resonant dip wavelength of the interferometer will shift due to the linear expansion or contraction and the thermo-optic effect. As a result, the temperature measurement can be achieved by monitoring the resonant dip wavelength of the interferometer. Experimental results show that the proposed sensor probe based on the peanut flat-end reflection structure works well and it can measure the temperature range from 100 ℃ to 900 ℃ with the sensitivity of 0.098 nm/℃ with R^2=0.988. When temperature ranges from 400℃ to 900℃, the sensitivity of 0.11 nm/℃ can be achieved with R^2=0.9995. Due to its compact and simple configuration, the proposed sensor is a good high temperature sensor probe.**

***Keywords*—high-temperature, reflected interferometer , peanut flat-end**

I. INTRODUCTION

Temperature, in scientific experiments and industrial productions, is one of the most important parameters which must be strictly controlled. So temperature measurements especially high temperature measurements are of great importance. Various types of optical fiber temperature sensors have been proposed. Among all the detecting methods, temperature sensors based on fiber Brag gratings (FBGs)[1-5] have attracted much attention due to their advantages on wavelength multiplexing for distributed measurements. However FBGs are usually fabricated by use of UV laser irradiation and the gratings fabricated in this way might not be operated at high temperature due to the tendency of being erased. In recent years, FBGs have been successfully fabricated by femtosecond laser pulse irradiation and exhibit excellent stability above 1000 ℃[6-8]. However the cost of such femtosecond laser fabrication systems is high, limiting their widespread applications.

With the development of fiber technology, other interferometer-based temperature sensors have been proposed. Michelson-based high-temperature sensors are robust and cheap but sometimes they are needed to polish or twist[9-10] which means complex processes are required. Fabry-Perot based high-temperature sensors[11-13] are usually small and suitable for remote sensing, but some based on FPI have to make a extremely small air-gap cavity such as positioning a glass microsphere in a capillary tube[12]which is a