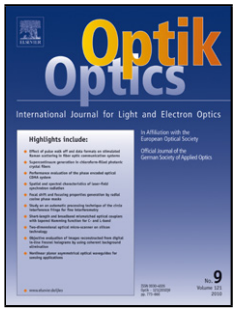

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PII: S0030-4026(17)31235-4
DOI: https://doi.org/10.1016/j.ijleo.2017.10.031
Reference: IJLEO 59767

To appear in:

Received date: 27-4-2017
Revised date: 4-10-2017
Accepted date: 5-10-2017

Please cite this article as: Jun-ni Cheng, A stepped Mach-Zehnder interferometric humidity sensor based on lateral offset fusion splicing, Optik - International Journal for Light and Electron Optics https://doi.org/10.1016/j.ijleo.2017.10.031

A stepped Mach-Zehnder interferometric humidity sensor based on lateral offset fusion splicing

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Abstract: A novel optical fiber relative humidity (RH) sensor based on a Mach-Zehnder interferometer (MZI) is proposed and demonstrated in this paper. The sensor head is formed by a single-mode-multimode-single-mode-single-mode(SM-MM-SM-SM) fiber structure through lateral offset fusion splicing. The intermodal interference is achieved by two lateral offset points. The change of relative humidity will cause the optical path difference changed of the core mode and cladding modes, which gives rise to the interference pattern change. The ambient RH change can be determined by monitoring the energy variation of the interference pattern. The experimental results show the dip energy of the transmission spectrum changes with respect to surrounding RH with good linearity. The MZI with a interferometer length of 15 mm offers the enhanced RH sensitivity of -0.0487dB/%RH in the range of 35~95%RH with linearity of 0.9966. The proposed humidity has compact size, simple fabrication procedure and does not need any functional coating, making it a good candidate for RH measurements.

Keywords: Optical fiber sensor; Multimode fiber; Relative humidity; Mach- Zehnder interferometer

1. Introduction

With the rapid development of wind power industry, wind power generation has been become a new and mature power generation technology. However, the majority of wind turbines are installed in outdoor area, high relative humidity and low temperature are a common problem faced by these wind farms, which leads to negative effect of wind turbines, including the unit corrosion, blade loading and lubricating oil and electronic components, parts of the performance, aerodynamic performance and load, unit operation and maintenance. Therefore, relative humidity measurement is particularly important [1].

Fiber-optical sensors have the unique advantages, such as small size, high sensitivity and good remote operation. Once these fiber sensors are inserted into the inside of each wind turbine by the way of parallel system, it can be achieved constant monitoring the operation of the wind turbine.