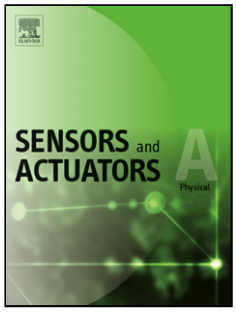


Title: Refractive Index and Strain Sensing Using Inline Mach-Zehnder Interferometer Comprising Perfluorinated Graded-Index Plastic Optical Fiber

Author: A.A. Jasim N. Hayashi S.W. Harun H. Ahmad R. Penny Y. Mizuno K. Nakamura

PII: S0924-4247(14)00349-5
DOI: http://dx.doi.org/doi:10.1016/j.sna.2014.07.018
Reference: SNA 8864

To appear in: *Sensors and Actuators A*

Received date: 18-4-2014
Revised date: 23-7-2014
Accepted date: 23-7-2014

Please cite this article as: A.A. Jasim, N. Hayashi, S.W. Harun, H. Ahmad, R. Penny, Y. Mizuno, K. Nakamura, Refractive Index and Strain Sensing Using Inline Mach-Zehnder Interferometer Comprising Perfluorinated Graded-Index Plastic Optical Fiber, *Sensors and Actuators: A Physical* (2014), http://dx.doi.org/10.1016/j.sna.2014.07.018

# Refractive Index and Strain Sensing Using Inline Mach-Zehnder Interferometer Comprising Perfluorinated Graded-Index Plastic Optical Fiber

A. A. Jasim[1,2], N. Hayashi[3], S. W. Harun[1,2], H. Ahmad[2], R. Penny[2], Y. Mizuno[3], and K. Nakamura[3]

[1]Department of Electrical Engineering, Faculty of Engineering, University of Malaya, Kuala Lumpur 50603, Malaysia.

[2]Photonics Research Center, University of Malaya, Kuala Lumpur 50603, Malaysia.

[3]Precision and Intelligence Laboratory, Tokyo Institute of Technology, Yokohama 226-8503, Japan.

**Abstract**

This paper details the fabrication and performance evaluation of an inline Mach-Zehnder interferometer (MZI) consisting of a perfluorinated graded-index plastic optical fiber fabricated via a heat-and-pull tapering technique. This MZI exhibits interference fringes that are sufficiently sharp for usage as refractive-index (RI) and strain sensors. These interference fringes shift linearly with the RI of the surrounding medium, with a proportionality constant of 3.44 nm/RI unit. The measured strain sensitivity of 0.2 pm/με suggests that the MZI may be viable for strain-sensing applications.

**Keywords:** Tapered fibers, plastic optical fibers, heat-and-pull technique, inline Mach-Zehnder interferometry, refractive-index sensing, strain sensing.