UNIVERSITI TEKNOLOGI MARA

MICROFIBER BRAGG GRATING SENSOR EMPLOYING ZINC OXIDE NANOSTRUCTURES AND NANORODS FOR ENVIRONMENTAL APPLICATIONS

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Electrical Engineering

February 2018

ABSTRACT

Fiber Bragg gratings (FBG) possess great potential in numerous applications due to its robustness, flexibility and high efficiency. The fabrication of an FBG into a microfiber extend the evanescent field outside the ambient-cladding boundary and enhance its responsivity towards environmental changes such as humidity and temperature. More importantly, the attachment of sensitive materials that induce strain and change in the refractive index (RI) are essential for manipulating FBG as a humidity sensor. Hence, this research aims at studying the effect of synthesizing zinc oxide (ZnO) nanostructures on a micro-FBG surface using the hydrothermal method. The energy efficient and low cost hydrothermal method resulted in a successful growth of the ZnO nanostructures. Due to the flexibility of the hydrothermal method in controlling the ZnO morphology, through modifications in the seeding technique and the growth process, a highly oriented ZnO nanorod arrays were successfully obtained. Based on the relative humidity (RH) sensor experiments, the ZnO nanorods coating generally exhibited a higher increase in sensitivity of 100% compared to that of the ZnO nanostructures coating which is 85%; both of which were measured against their bare counterpart. Owing to the superior performance of ZnO nanorods, its implementation in temperature sensing effectively demonstrated a 24 times improvement from the bare micro-FBG, bringing down the sensor resolution value to 0.02°C from 0.48°C originally.

ACKNOWLEDGEMENT

First and foremost, I would like to dedicate my utmost gratitude towards my main supervisor, Dr. Husna Abdul Rahman for her patience, guidance and encouragement throughout my time under her supervision. I am incredibly thankful for all the advices and valuable suggestions given which are helpful in completing this thesis.

My deepest appreciation goes out to my co-supervisor, Prof. Dr. Sulaiman Wadi Harun for offering me the opportunity to carry out my research at Photonics Research Centre (PRC) and Nanotechnology Lab, University of Malaya and also for his endless support during my time there.

I am very grateful towards Dr. Lim Kok Sing from PRC for providing me the fiber Bragg gratings that are essential for my research. A special thanks goes to Assoc. Prof. Dr. Roslan Md Nor for generously lending me his lab equipment during the early stage of my synthesis works.

My big sincere gratitude towards my fellow colleagues at PRC for the great moments I had when working together and for their great guidance, assistance and all the helpful discussions.

I would also like to extend my greatest appreciation towards my family members for their undying support all this while.

Lastly, to those who had contributed to this work either directly or indirectly, I thank you from the bottom of my heart.

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