

**UNIVERSITI TEKNOLOGI MARA**

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

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## 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.

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