

## Optical fiber coated Zinc Oxide (ZnO) nanorods decorated with Palladium (Pd) for hydrogen sensing

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### ABSTRACT

A novel hydrogen (H<sub>2</sub>) sensor was developed using acid-etched optical fiber coated with zinc oxide (ZnO) nanorods. The sensing performance was done by comparing the acid-etched fiber coated with ZnO nanorods with and without decorated Palladium (Pd). The conventional optical single-mode fiber (SMF) with a diameter of 125 μm has been modified as a transducing platform by etching it to 11 μm diameter using hydrofluoric acid (HF) to enhance the evanescent field of the light propagates in the fiber core. The etched fiber was coated with ZnO nanorods via hydrothermal process by using seeding and growth solution method. The sensing layer was characterized through Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray (EDX) and X-Ray Diffraction (XRD) to verify the properties of ZnO. Catalyst Palladium (Pd) was sputtered onto the ZnO nanorods to improve H<sub>2</sub> detection. The developed sensor operating temperature was found to be 150 °C that produces 6.36 dBm increase in response towards the 1% concentration of H<sub>2</sub> in synthetic air. It was then tested with different concentration of H<sub>2</sub>. The sensor decorated with Pd has better performance in sensing compared to non-decorated Pd based on the output power versus time. The sensor best response and recovery times is 6 and 5 min respectively, for acid-etched optical fiber coated with ZnO nanorods decorated with Pd for 0.75% of H<sub>2</sub> concentrations at 150 °C. The results indicate the optical fiber sensor might improve the performance towards H<sub>2</sub> as oppose to the conventional electrical sensor.

**KEYWORDS**

Hydrogen sensor; Etching optical fiber; Fiber optic sensor; Light-intensity; response; Zinc oxide nanorods; Hydrothermal method

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