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Highly Sensitive Hydrogen Gas Sensor based on Fiber Bragg Grating (FBG) and Laser ablation technology

Hydrogen gas is a recyclable, abundant, and environmentally friendly source of energy. However, its highly flammable and explosive gas at 4% limit in air.
In this research, the relationship between hydrogen concentration and peak wavelength shift of FBG optical fiber sensors were investigated and analyzed experimentally. In order to enhance its sensitivity, the fiber cladding was ablated into micro-cavities using Femtosecond laser. Ablation increased the surface area of the fiber cladding covered by hydrogen sensitive transducer. The Pt-WO3 nano-lamellae prepared by hydrothermal process at molar ratio of 1:5 respectively and deposited on the surface of fiber micro-cavities. Tungsten oxide (WO3), reacts exothermically with low concentration hydrogen gas (0-0.5%) under Pt catalyst generating massive heat leading to FBG central wavelength shift. The optical sensor fabricated exhibits a high sensitivity of 170 pm/H% within the range of 0–1.4% at room temperature. This translates to approximately three times higher than the unprocessed standard FBG.

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