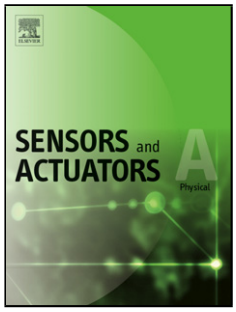

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Highly sensitive and fast UV sensor based on fiber grating with easily producible photoreactive material

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Highlights

- Azobenzene polymers improved fiber Bragg grating sensor ultraviolet sensitivity.
- Sensitivity of fiber Bragg grating sensor related to hardness of coating material.
- Fiber Bragg grating achieved fast response time of 17 ms.
- Reaction speed limitation of ultraviolet sensor addressed with simple algorithm.

Abstract

In this paper, a newly synthesized material has been proposed to improve the ultraviolet (UV) sensitivity of a non-etched fiber Bragg grating (FBG) for UV sensors, comparable to the high sensitivity of a previously reported UV sensor based on a diameter-downsized FBG. The photomechanical material was prepared simply by mixing an azobenzene compound and curing agent. An FBG was subsequently coated with the functional polymer using the UV curing process. We determined the best combination of the azobenzene compound exhibiting UV-induced mechanical stretching and the curing agent as a commercially available coating polymer to achieve the highest sensitivity in many combinations. The maximum wavelength shift of the non-etched FBG was 2.5 nm at a UV power of ~2.5 mW/cm^2. The sensitivity of the sensor was found to be related to the hardness of the coating material. In addition, we suggested a simple algorithm to determine the presence and absence of UV radiation using the change in the slope of the wavelength shift over time obtained through the first derivative of the measured data. The proposed method is very easy to use, providing the information at a glance, and our fast UV sensor is sufficiently powerful for applications such as corona discharge detection and lightning strike monitoring.

Keywords: Ultraviolet; Fiber optic sensors; Fiber Bragg grating; Photosensitive materials.