Small and Robust All-Polymer Fiber Bragg Grating based pH Sensor

The smallest all-polymer optical fiber Bragg grating based transducer element for pH sensing is presented. We show that, considering its size and robustness, it out-performs similar state-of-the-art fiber Bragg grating based pH sensors regarding both sensitivity and response time. A 5 μm - 10 μm thick pH sensitive hydrogel coating is placed on a PMMA based microstructured Polymer Optical Fiber Bragg Grating (mPOFBG). The hydrogel expands or contracts depending on the pH and thus changes in pH are monitored by following the fiber strain induced changes in the reflected Bragg wavelength $\lambda_B$. Prior to applying the hydrogel coating the mPOF is etched from 150 μm to 80 μm to enhance sensitivity and surface crazing is introduced with a 50/50 vol% solution of acetone and methanol to enhance spreading of the hydrogel during the application and adhesion after cure. With this design we achieved a sensitivity of $\Delta \lambda_B = 73 \text{ pm/pH}$ ± 2 pm/pH and response times below 4.5 mins. for pH 5 - 7 and 4 - 7 respectively and a thermal cross sensitivity of 31.4 pm/°C ± 0.4 pm/°C.