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Optical Fiber Relative Humidity Sensor Based on Fabry-Perot Interferometer Coated with Sodium-p-styrenesulfonate/Allyamine Hydrochloride Films

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We report on a fiber optic relative humidity (RH) sensor by coating negatively charged poly(sodium-p-styrenesulfonate) (PSS) nanoparticles and positively charged poly(allyamine hydrochloride) (PAH) nanoparticles on the endface of an intrinsic Fabry-Perot interferometer (IFPI) by a layer-by-layer (LbL) electrostatic self-assembly method. The IFPI, formed by a section of a hollow-core photonic crystal fiber (HCPCF) and standard single-mode fibers (SMFs), is fabricated using a fusion splicer. The LbL electrostatic self-assembly process of a PAH/PSS multilayer is traced with a quartz crystal microbalance and shows a fast thickness growth. The optical response of the modified RH sensor to different RH values is evaluated on the basis of the maximum fringe contrast of the interference fringes in the reflective spectra. A high sensitivity of 0.08 dB/%RH is achieved. It shows response times of 2 and 6 s in the RH increasing and decreasing processes, respectively. In addition, the IFPI sensor has good stability and highly reversible performance. The proposed sensor shows excellent thermal stability as well.

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