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Squeezed hollow-core photonic Bragg fiber for surface sensing applications

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We propose to use squeezed hollow-core photonic bandgap Bragg fibers for surface sensing applications. We demonstrate theoretically and confirm experimentally that squeezing of the Bragg fiber core increases overlap between the optical fields of the core guided modes and the modes bound to the sensing layer, thus, significantly enhancing their interaction via anticrossing phenomenon, which, in turn, enhances surface sensitivity of the fiber sensor. As a practical demonstration, we apply our fiber sensor to in-situ monitoring of the dissolution dynamics of a sub-micron-thick polyvinyl butyral (PVB) film coated on the surface of the liquid-filled Bragg fiber core. Strong spectral shift is observed during the dissolution of the PVB film, and a surface spectral sensitivity of ˜0.07nm/nm is achieved experimentally with aqueous analytes. The proposed fiber sensor offers a new sensing modality and opens new sensing applications for photonic bandgap fibers, such as real-time detection of binding and affinity, study of kinetics, etc. for a range of chemical and biological samples.

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