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Bio-functional subwavelength optical waveguides for chemical detection. DONALD SIRBULY, OLGICA BAKAJIN, ALEKSANDR NOY, Lawrence Livermore National Laboratory — Compact, reusable biochemical sensors are highly desirable for rapid on-site analytical analysis of gas and liquid mixtures in the field. A key to miniaturizing devices and providing reliable quantitative chemical identification of small sample volumes hinges on the development of novel materials capable of multiple complementary sensing modalities. Here we build a bio-functional optical sensing platform that utilizes the evanescent field of a sub-wavelength nanowire waveguide to detect single biochemical molecules. The optical cavities are integrated into polymeric flow cells for rapid chemical functionalization, multiplex sensing and reusability. The biocompatibility of the waveguide is assured by assembling fluid lipid membranes tagged with receptor molecules within the evanescent field. With the advantage of carrying out multiple spectroscopy techniques such as absorbance, fluorescence and surface enhanced Raman spectroscopy (SERS) on sub-picoliter probe volumes, these evanescent field sensors offer a unique design for portable all-optical detection systems. This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

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