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Research leads to novel optofluidics platform of long optical path for robust chem/bio sensing

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A research paper that has potential implications for homeland defense, work place safety, and health care has been published in the *Journal of Advanced Materials*.

Stevens Institute of Technology's Dr. Henry Du, Professor and Director of the Department of Chemical Engineering and Materials Science, together with Dr. Svetlana Sukhishvili, Professor of Chemistry and Co-Director of Stevens' Nanotechnology Graduate Program, supervised a research team consisting of Yun Han, Siliu Tan, Maung Kyaw Khaing Oo, and Denis Pristinski, and jointly authored the paper "Towards Full-Length Accumulative SERS-active Photonic Crystal Fiber."

The team has pioneered work in the integration of nanotechnology with photonic crystal fibers (PCF) for ultra-sensitive sensing and detection based on surface-enhanced Raman scattering (SERS). This paper stems from a major research project funded by the National Science Foundation that utilizes molecular and nanoscale surface modification, state-of-the-art laser techniques, and computer simulation for sensor development both from fundamental and applied standpoints.

The Stevens team has demonstrated that PCF optofluidic platform can be endowed the SERS capacity along the entire fiber, a first in the field. The team has shown the competitive interplay between SERS gain and light attenuation as the optical path length increases for PCF containing immobilized Ag nanoparticles, with low particle coverage density being essential for a net accumulative Raman gain throughout the fiber. Key to achieving the SERS-active PCF optofluidic platform lies in the high degree of control of nanoparticle coverage density via polyelectrolyte-based surface modification, which can be applied to PCF of unlimited fiber length.

SERS-active PCF optofluidic platform is inherently easy for system integration, robust in light coupling and harvesting, and unparalleled in optical path length for label-free and sensitive identification, according to Dr. Du. Its potential applications include fundamental studies of chemical, biological, and catalytic interactions in geometrically confined systems; chemical and biological sensing and detection; in situ process and health monitoring.

Provided by Stevens Institute of Technology

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