Non-labeling multiplex surface enhanced Raman scattering (SERS) detection of volatile organic compounds (VOCs)

In this paper, we report multiplex SERS based VOCs detection with a leaning nano-pillar substrate. The VOCs analyte molecules adsorbed at the tips of the nano-pillars produced SERS signal due to the field enhancement occurring at the localized surface plasmon hot spots between adjacent leaning nano-pillars. In this experiment, detections of acetone and ethanol vapor at different concentrations were demonstrated. The detection limits were found to be 0.0017 ng and 0.0037 ng for ethanol and acetone vapor molecules respectively. Our approach is a non-labeling method such that it does not require the incorporation of any chemical sensing layer for the enrichment of gas molecules on sensor surface. The leaning nano-pillar substrate also showed highly reproducible SERS signal in cyclic VOCs detection, which can reduce the detection cost in practical applications. Further, multiplex SERS detection on different combination of acetone and ethanol vapor was also successfully demonstrated. The vibrational fingerprints of molecular structures provide specific Raman peaks for different VOCs contents. To the best of our knowledge, this is the first multiplex VOCs detection using SERS. We believe that this work may lead to a portable device for multiplex, specific and highly sensitive detection of complex VOCs samples that can find potential applications in exhaled breath analysis, hazardous gas analysis, homeland security and environmental monitoring.

General information
Publication status: Published
Organisations: Department of Micro- and Nanotechnology, Nanoprobes, Singapore Bioimaging Consortium, National University of Ireland
Contributors: Wong, C. L., Dinish, U. S., Schmidt, M. S., Olivo, M.
Pages: 54-60
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Analytica Chimica Acta
Volume: 844
ISSN (Print): 0003-2670
Ratings:
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.64 SJR 1.544 SNIP 1.471
Web of Science (2014): Impact factor 2.003
Web of Science (2014): Indexed yes
Original language: English
Keywords: Surface enhanced Raman scattering, SERS, Volatile organic compounds (VOCs) detection, Multiplex detection, Non-labeling
DOIs: 10.1016/j.aca.2014.06.043
Research output: Contribution to journal › Journal article – Annual report year: 2014 › Research › peer-review