Roshan L Aggarwal et al., J Phys Chem Biophys 2014, 4:5
http://dx.doi.org/10.4172/2161-0398.S1.006

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2nd International Conference and Exhibition on
Lasers, Optics & Photonics
September 08-10, 2014 Hilton Philadelphia Airport, USA

Sensitive detection of aerosols and gases using Raman scattering

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We report the development of a very sensitive and compact (<5 ft^3) apparatus for the detection of aerosols and gases. This apparatus has achieved an aerosol detection sensitivity of <250 pg/cm^3 for isovanillin and a gas detection sensitivity of <160 ng/cm^3 for methyl salicylate with a 30-s signal integration time. This apparatus uses a 10-W 532-nm continuous wave (CW) pump laser, which is double passed through the sample volume. The Raman scattered radiation is collected with an efficiency of ~8% using double-sided collection with f/1.0 lenses. The collected Raman radiation is spectrally analyzed with an f/1.8 Raman spectrometer, which has a resolution of ~10 cm^{-1} using a 100 μm slit.

Biography

Roshan L Aggarwal is a technical staff member in the Chemical, Microsystem, and Nanoscale Technologies Group in the Advanced Technology Division at MIT Lincoln Laboratory pursuing applications of Raman spectroscopy. Previously, he was a Senior Research Scientist in the Department of Physics and an Associate Director of the Francis Bitter National Magnet Laboratory at MIT. Most recently, he has worked on Raman spectroscopy and surface-enhanced Raman spectroscopy, which involved the measurement the absolute Raman cross sections of several materials including benzenethiol, diamond, gallium phosphide and silicon using a temperature-calibrated blackbody for the signal calibration of the Raman system. Also, standoff Raman detection of a 6-mm thick specimen of sulfur was demonstrated for a distance >1.0 km using a 1.4 W CW 785 nm laser. He has authored or coauthored >200 papers in peer-reviewed journals and participated in numerous conferences.

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