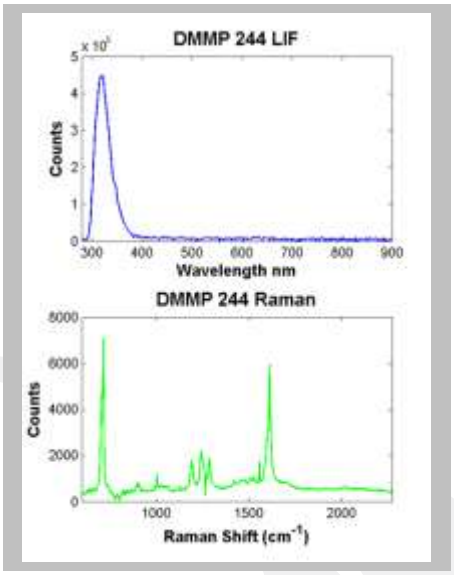
Simultaneous Raman and LIF signatures of CBE under Deep-Ultraviolet Excitations | STTR II

US forces are increasingly involved in asymmetric warfare, peacekeeping and humanitarian assistance missions. These scenarios can place soldiers in direct contact with harmful biological and chemical warfare organisms and agents, toxic industrial chemicals, and explosives. Current portable sensor technology solutions rely on visible and near-IR Raman or Fluorescence spectroscopy. A portable sensor system that combines both Raman and Fluorescence measurements using Deep UV (DUV) Excitation may improve detection and classification of trace amounts of substances at stand-off distances.

In this effort, simultaneous Raman and LIF signatures were measured for more than 50 chemical, biological, and explosive analytes and common interferents as well as 150 mixtures, using a single 244-nm DUV excitation laser. Raman and LIF signatures for a smaller subset of these analytes were also measured using 229 nm, 238 nm, and 248 nm excitation lasers in order to understand the signature dependence on excitation wavelength. Time-resolved LIF and Raman measurements were also performed to understand the time dependence of these signatures.



Example of Raman and Laser-Induced fluorescence signatures acquired simultaneously using a 244-nm excitation laser source.

All of the measured data was used to develop detection algorithms and to evaluate performance. In particular, this data has been used to determine whether the simultaneous collection of LIF spectra alongside Raman spectra enables a reduction in the required resolution for the Raman spectrometer, and a corresponding reduction in system size and weight, while still achieving detection performance equal to or better than a sensor using Raman measurements alone.

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