UV Raman Spectroscopy for Explosives Detection

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The purpose of this work was to detect explosive traces at a safe distance from the material and within few seconds of testing time. Raman spectroscopy has been used to uniquely identify unknown substances at a safe distance from the examination site for homeland security applications [1,2].

UV Raman spectra of RDX and PETN were detected over a remote distance of 60 centimeters. All spectra were background subtracted. Standardized samples of milligrams and traces (µg range) were weighed and then applied on a glass substrate. The prepared samples simulate a possible explosive trace adhering on a surface. The sample areas were prepared to be below the upcoming laser beam size. A portable 355 nm laser was set at 1 mW. A longpass filter was placed in front of the spectrometer to reject incoming laser radiation. The signal was collected with a UV lens and then sent through a spectrometer.

Fig.1 shows an example of RDX spectra (blue) and PETN spectra (red) acquired sampled in 20 seconds. The amount of explosives shown is ~80 µg.

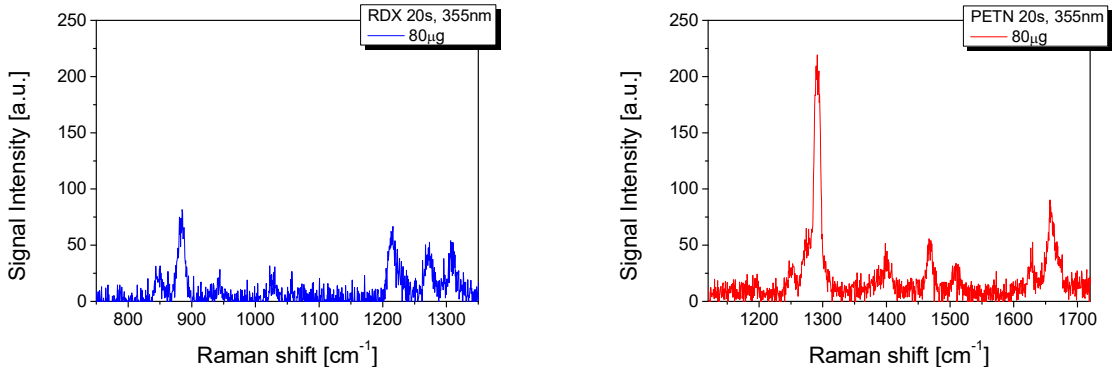

Fig. 1: RDX and PETN sample ~80µg, 20s sampling time

In this study a UV Raman set up for measuring explosive materials was tested. The lowest detection limit was in the range of 40 µg for 0.6 meters remote detection. For each explosive at least one vibrational line can be distinguished so that the suspicious compound can be successfully identified over the others.

[1]. R. Chirico, S. Almaviva, F. Colao, L. Fiorani, M. Nuvoli, *Proximal Detection of Traces of Energetic Materials with an Eye-Safe UV Raman Prototype developed for Civil Applications*, Sensors, 2015,vol: 16, page 8.

[2]. S. Gulia, K.K. Gulati, V. Gambhir, R. Sharma, M.N. Reddy, *Trace Detection of Explosive and their Derivatives in Stand-off mode using Time Gated Raman Spectroscopy*, Elsevier Vibrational Spectroscopy, 2016, vol: 87, pages 207-214.