UV Raman Spectroscopy for Explosives Detection

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Objective:
• Identification of explosive traces at a safe distance using UV Raman spectroscopy
  • Determination of the detection limits for samples on glass substrates. μg amounts resemble a chemical trace left by a fingerprint

Lab setup:
• Portable 355 nm, 224 nm lasers
• Collecting optics: UV lens ~ 60 cm in front of the sample - spectrometer (liquid N\textsubscript{2} cooled CCD, grating 2400 grooves/mm, laser line filter)
• Photo degradation minimized (laser energy < 10 mW/cm\textsuperscript{2})
UV Laser beam features:
  1 mW, 3 s minimum acquisition time

Sample preparation:
• Standardized samples of milligrams and traces (μg range) were ink-jet printed on a glass substrate
• Samples simulate possible explosive trace amount adhering on a surface

Results:

• PETN (red) and RDX (blue), samples < 100 μg, 20 s, 355 nm:

  • Minimized acquisition time 3 s, 355 nm, < 100 μg and < 50 μg:

Findings:
• A UV Raman setup for measuring explosive traces was successfully tested
• Lowest detection limit was < 50 μg for 0.6 m distance for 3 s, at 355 nm
• No distinguishable signal for laser at 224 nm: too close to absorption peaks
• Tested compounds successfully identified

Future developments:
• Find the optimum excitation wavelength for later applications (i.e. miniaturization)
• Test different surfaces, inhomogeneous contamination, low concentrations
• Eye safe range