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Terahertz Raman Spectroscopy

Instrumental Aspects and Preliminary Studies on Intermolecular Interactions

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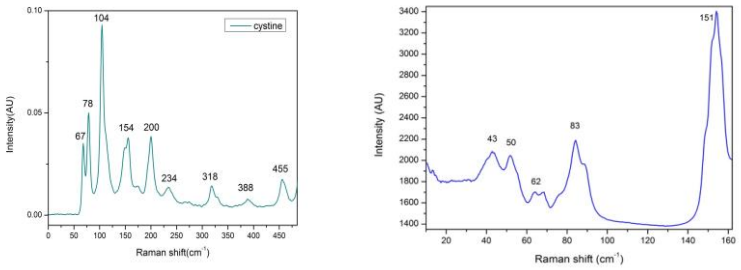
Abstract: Molecular vibrations provide a straightforward approach to identify chemical signatures of various moieties present within a molecule. Because of practical difficulties, spectroscopists using IR absorption or Raman scattering are focusing mostly on fingerprint vibrations, which are highly selective for individual functional groups. However, there are several different motions which fall in the category of collective vibrations or reflect weak intermolecular interactions. These vibrations are extremely low in energy (0.1-10 THz or 3-300 cm^{-1}) and it is very difficult to detect them with traditional instrumentation.

We have developed a Terahertz Raman spectrometer based on Volume Bragg Gratings (VBGs) to detect these low-energy vibrational modes. The performance of the spectrometer was characterized using standard model compounds (shown below).



Terahertz Raman spectrum of L-cystine (left) and Sulfur powder (right), taken with 785 nm excitation. Acquisition time =10x1sec

References:

- Hamaguchi and Okajima, *Applied Spectroscopy*, **63(8)**,958-960, 2009
- Havermayer F and Moser C, *Appl Phys B*, **95**, 597-601, 2009