

Kinetic Measurements in Acoustically Levitated Terpene Droplets

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Raman Acoustic Levitation (RAL) was employed for chemical analysis of the behaviour of selected terpenes. The ageing of droplets of terpenes such as α -pinene was analysed in the presence of the bath gases nitrogen, oxygen and ozone. Changes in the chemical composition of the levitated droplets was followed as a function of time.

Volatile Organic Compounds (VOCs) play an important role in atmospheric chemistry¹. Vegetation is a key source of VOCs². These biogenic VOCs include isoprene and a variety of terpenes. α -Pinene is one of the major terpene components and has received considerable attention³. Individual droplets of organic compounds can be studied by techniques such as acoustic (ultrasonic) levitation⁴. For the Raman Acoustic Levitation (RAL) studies presented here we combined ultrasonic levitation with Raman microscopy (see Fig. 1).

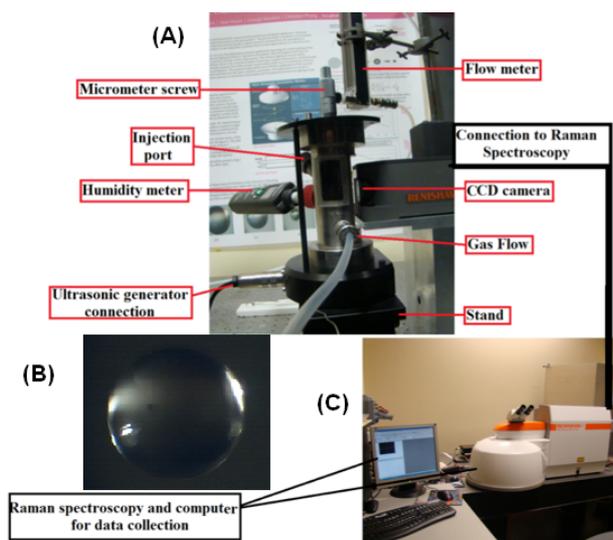


Fig. 1 (a & c) depict the levitation system coupled to a Raman microscope; and (b) shows an image of a levitated α -pinene droplet in nitrogen.

Fig. 1 (b) illustrates an acoustically levitated α -pinene droplet and Fig. 2 displays the corresponding Raman spectra. An unexpected oxidation peak appeared both in nitrogen and oxygen at room temperature and 80% relative humidity (RH) as shown in Fig. 2 (b).

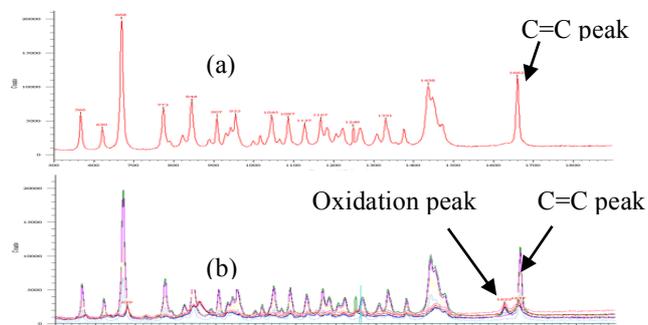


Fig. 2 Full range Raman spectra for a levitated α -pinene droplet (initial diameter: 0.99 mm) under N_2 and 80% RH for (a) $t = 0$ and (b) $t = 7.5$ min.

The appearance of the oxidation peak has been investigated under both wet and dry conditions in nitrogen and oxygen environments.

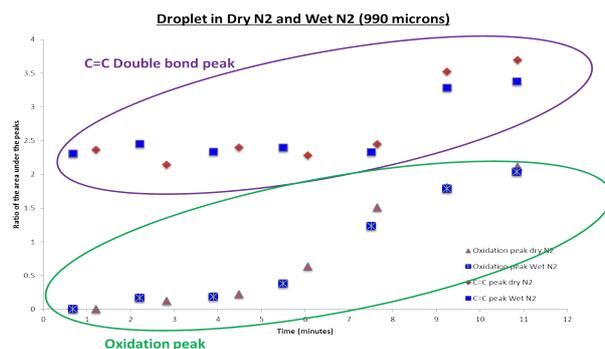


Fig. 3 Measurements of relative peak areas in the Raman spectra as a function of time for levitated α -pinene droplets in N_2 (the peak areas are normalised to an inert peak at ca. 1086 cm^{-1}).

From Fig. 3 it becomes apparent that the oxidation peak is observed even under nitrogen gas, and no significant difference is seen for dry and wet conditions. To further investigate this unexpected effect, detailed analysis is currently being carried out at Reading.

References

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