SERS pH nanoprobes in single, levitated aerosols particles

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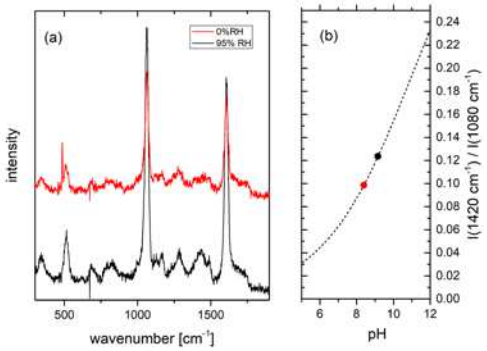
Surface enhanced Raman scattering (SERS) pH nanoprobes are used for assessing pH in micron size, single aerosol particles levitated in an electrodynamic balance. The nanoprobes consist of multiple gold nanoparticles with the pH sensing capacity realized via surface functionalization of the particle with the pH sensitive molecule 4-mercaptobenzoic acid (4-MBA) [1]. The figure shows in panel (a) spectra of a levitated aqueous polyethylene glycol droplet at two different relative humdities (RH), under dry conditions (red) and at about 95% RH (black).



The most prominent Raman band observed in these spectra is that of the benzene ring of 4-MBA at 1080 cm^{-1}. This band remains constant upon changes in solution pH while the band at 1420 cm^{-1} (-COO-) decreases in intensity and shifts slightly in position with decreasing pH. Measurements in buffer solution have been used to construct the pH-calibration curve shown in panel (b) [1]. According to this calibration, the pH of the levitated, aqueous solution droplet decreased from 9.16 under humid conditions to 8.39 under dry conditions. Buffered aqueous solution droplets will be investigated in futrue experiments to establish the stability of the calibration curve in the high ionic strngth regime, as aerosol particles will become supersaturated with respect to crystalline phase upon drying.

[1] Wei et al. (2016) Analyst **141**, 5159−5169.