Atmospheric
Measurement
Techniques

Supplement of

A universal aerosol composition analysis method for optical tweezers measurement and its application to determine hygroscopic growth factor of single-particle aerosol

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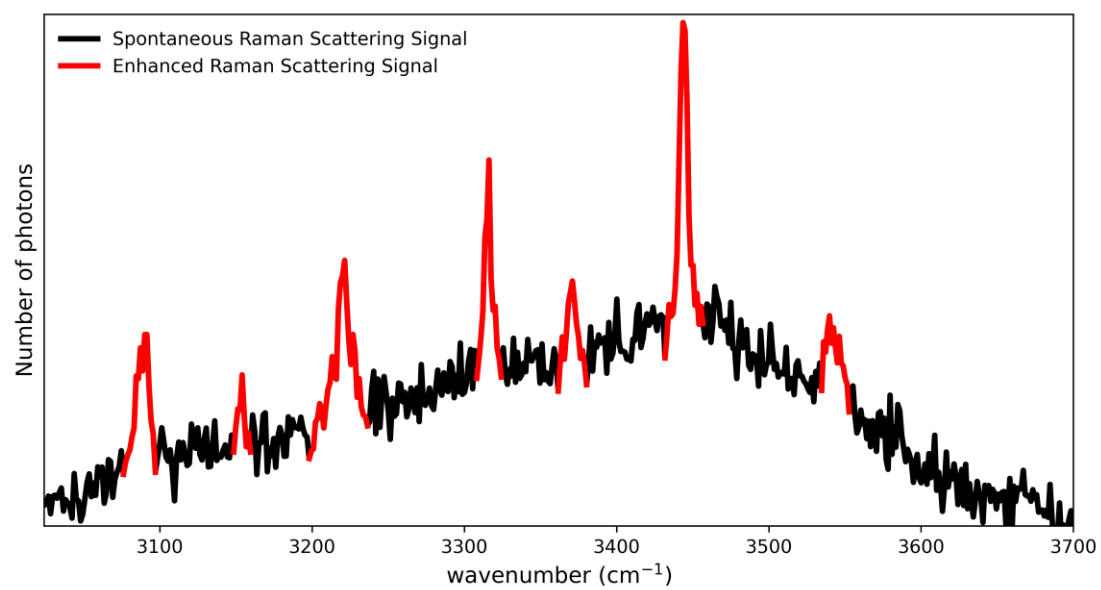*Correspondence to:* Chunsheng Zhao (zcs@pku.edu.cn)

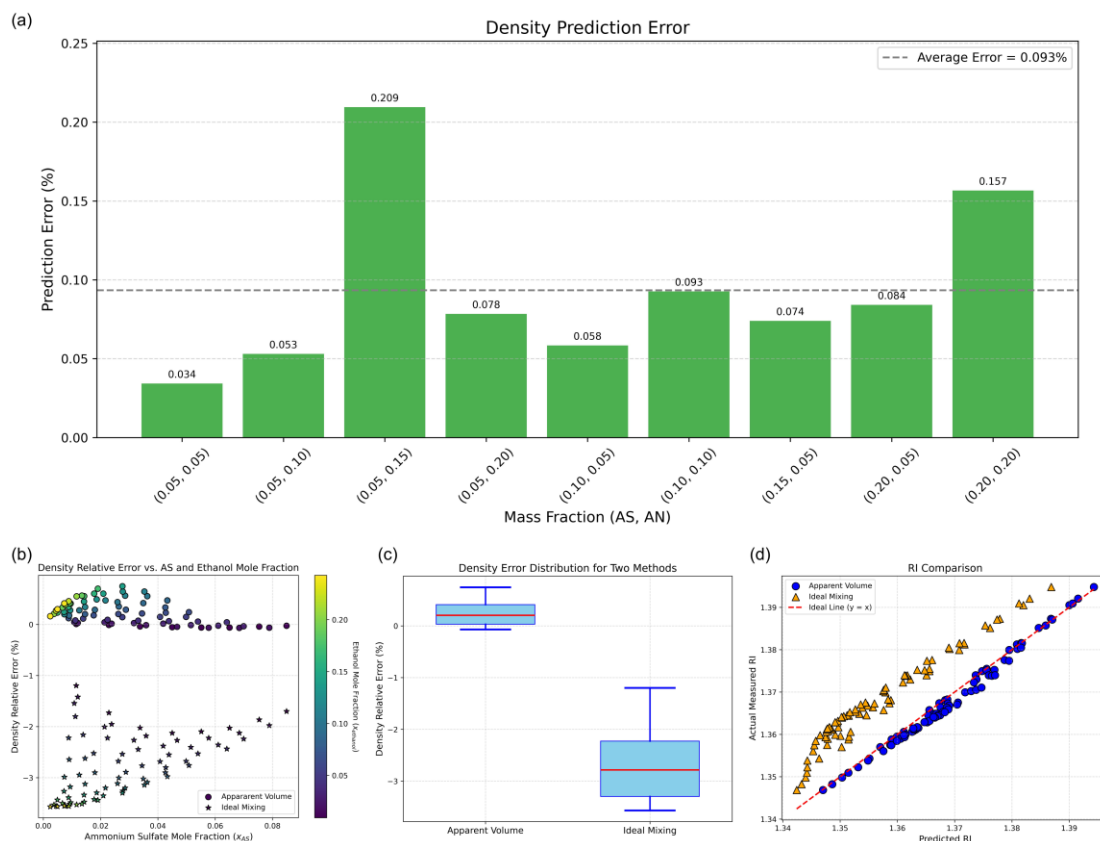**Figure S1.** Schematic diagram of whispering gallery modes

Figure S2. Density and refractive index of mixed solutions calculated using the apparent molar volume method and the molar refraction method. (a) Density error of ammonium sulfate–ammonium nitrate mixtures at different mass fractions calculated by the apparent molar volume method, with a mean error of <1%. (b) Comparison of densities of ammonium sulfate–ethanol mixtures calculated using the apparent molar volume method and the ideal mixing density assumption. (c) Boxplots of density errors from the two methods. The box plot boundaries represent, from top to bottom: maximum value, third quartile (Q3), median, first quartile (Q1), and minimum value. (d) Comparison of measured refractive indices with values calculated by the molar refraction method using densities from the two approaches.
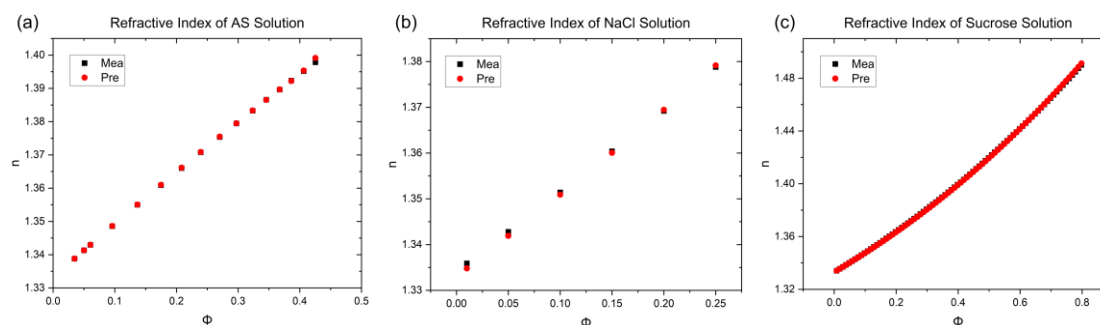

Figure S3. Retrieval of solute molar refraction using refractive indices of solutions at different mass fractions as constraints: (a) ammonium sulfate, (b) sodium chloride, and (c) sucrose.
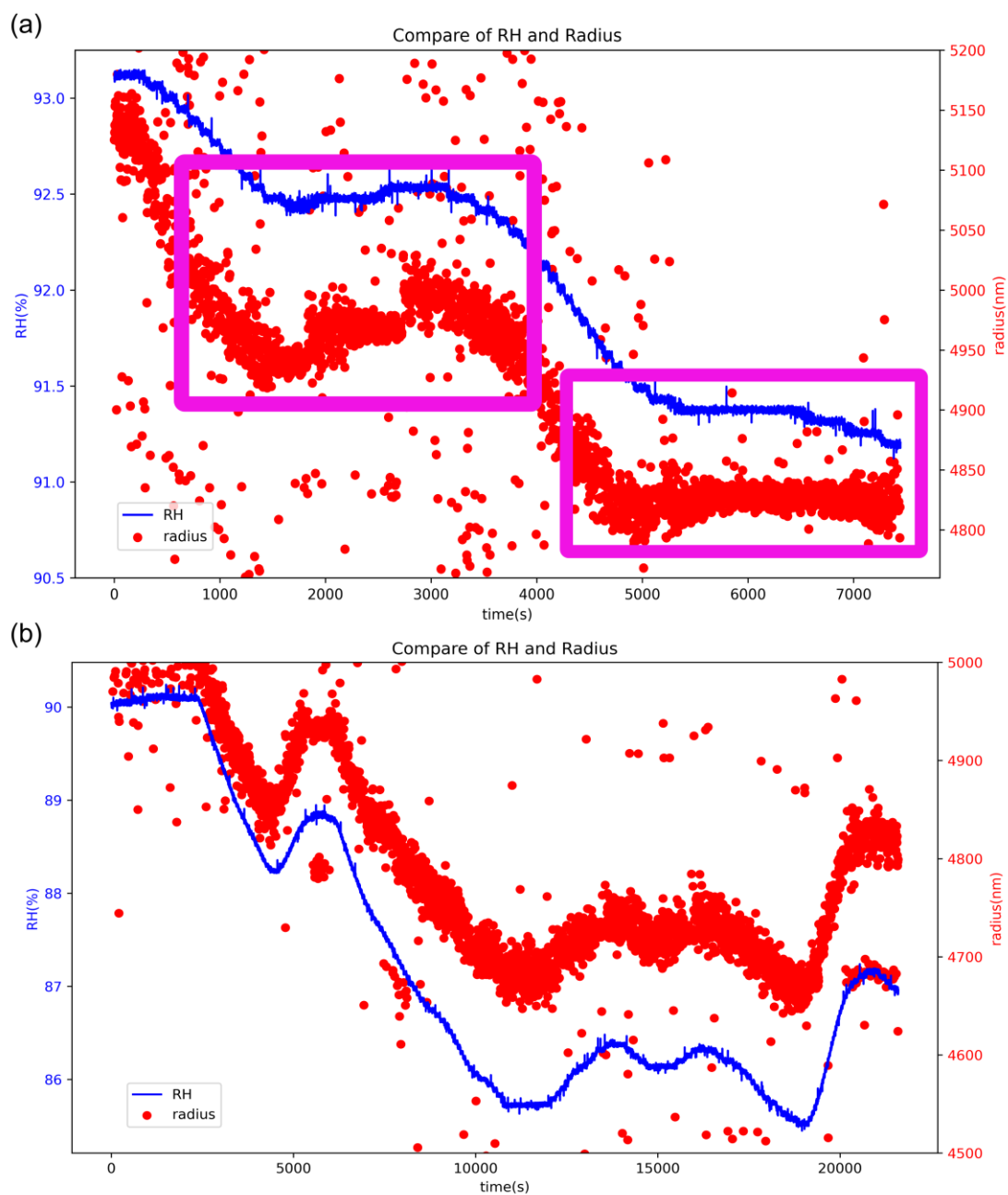
Figure S4. The radius of an ammonium sulfate particle under varying relative humidity. (a) 93%–91%; the purple shaded box indicates the time period during which RH was stable and the particle radius was averaged. (b) 90%–87%.
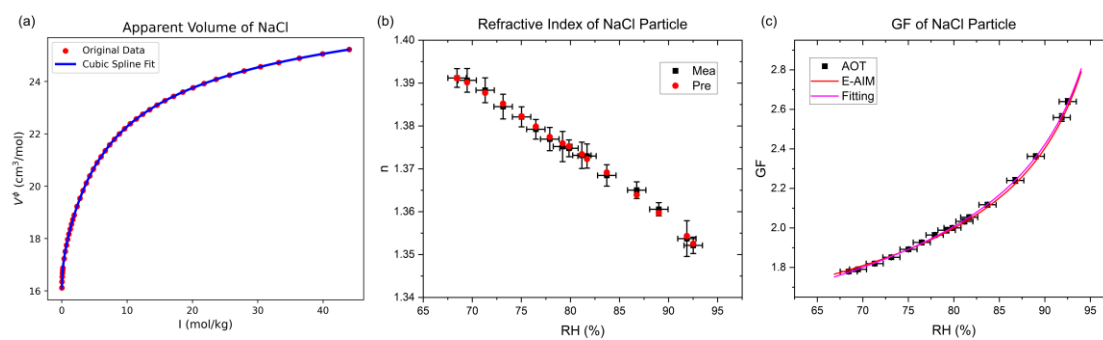
Figure S5. Measurement of sodium chloride hygroscopicity. (a) Apparent molar volume of NaCl as a function of ionic strength. (b) Measured refractive index and corresponding values derived from the constrained solute mass. (c) Hygroscopic growth factors of NaCl particles, together with the fitted growth curve and the E-AIM prediction.
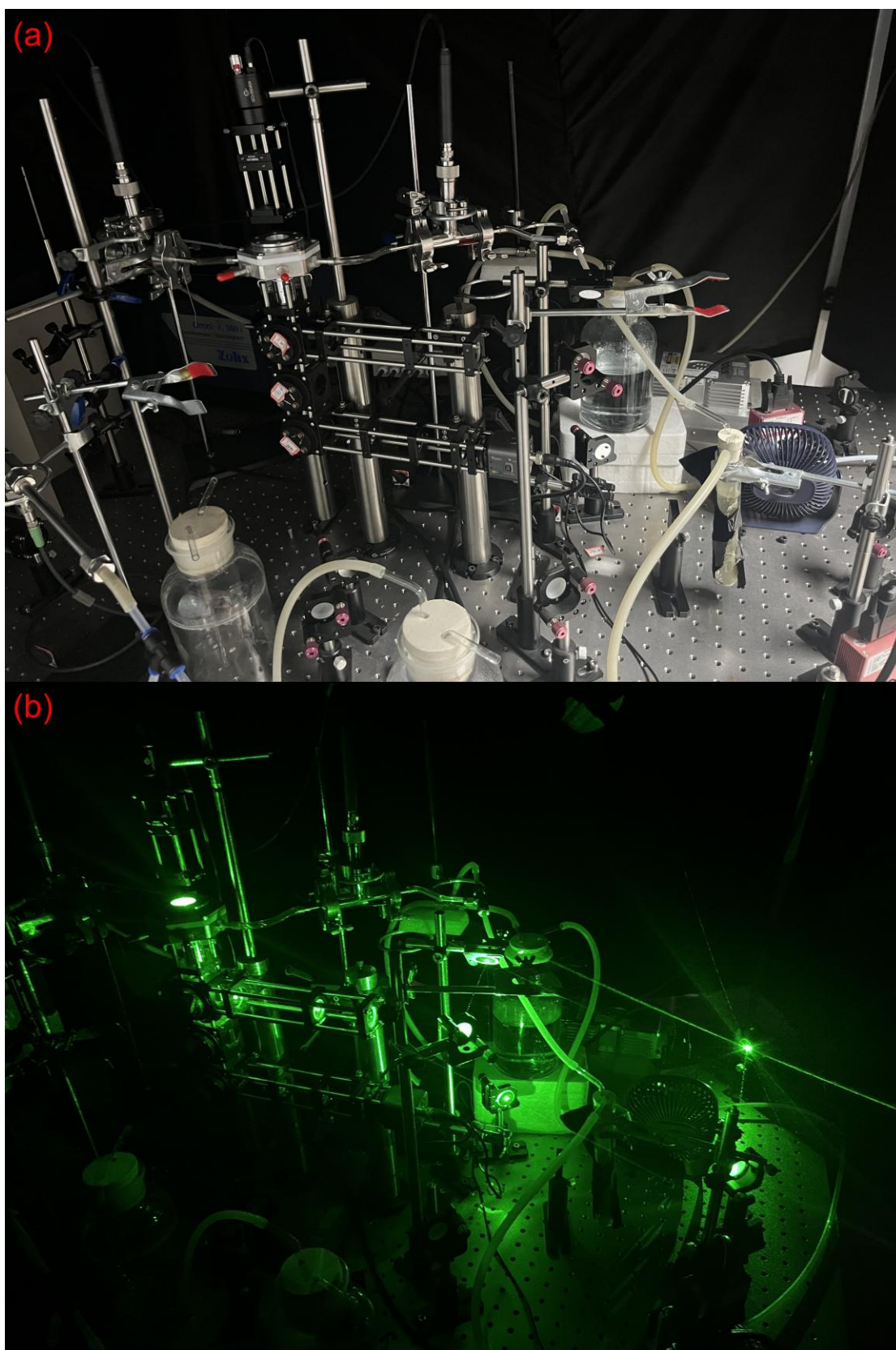
Figure S6. Live-action image of the optical tweezers system. (a) Before the laser is turned on. (b) After the laser is turned on