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Binary Aerosol Composition Measurements using Ultra Small Angle X-ray Scattering[1] DANIEL DUKE, HARRY SCOTT, ANESU KUSANGAYA, DAMON HONNERY, Monash University, BRANDON SFORZO, KATARZYNA MATUSIK, ALAN KASTENGREN, MATTHEW FRITH, JAN ILAVSKY, Argonne National Laboratory, DAVID LEWIS, Chiesi Limited — Nearly all consumer aerosols are binary mixtures of a product in a liquefied propellant. In the pressurised metered dose medical inhaler (PMDI) for example, drugs may be dissolved in ethanol if their solubility in the propellant is poor. The rate of change of liquid composition as the propellant flash-evaporates strongly affects precipitation of the inhaled particles. However, aerosol composition is difficult to measure in an optically dense flash evaporating spray. A novel approach to this problem is demonstrated using Ultra-Small Angle X-ray Scattering (USAXS) on a PMDI solution of 3.38 μg/μL ipratropium bromide, 85% $^{v}/_{v}$ R-134a propellant and 15% ethanol. The experiments were conducted at the 9-ID & 7-BM beamlines of the Advanced Photon Source at Argonne National Laboratory. USAXS exploits the high electron density of R-134a relative to ethanol, which leads to a measurable change in X-ray scattering cross-section at the droplet surface. By combining USAXS with X-ray radiography and laser diffraction, the change in cross-section can be measured using Porods Law. From this, an ensemble average composition is determined. This new approach enables quantitative validation of binary droplet evaporation models and may lead to improvements in nozzle design.

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