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Aerosol-Assisted Synthesis of Submicron Particles at Room Temperature Using Ultra-Fine Liquid Atomization

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ABSTRACT

Aerosol-assisted particle technologies are common in commercial atomizing devices for producing micron-sized droplets, which upon evaporation of solvent typically yield particles in the micron to submicron range obtained from a process of droplet-to-particle conversion. In this paper, we demonstrate a technology that allows room-temperature manufacturing of particles *O*(100-500) nm in diameter by generating and drying of submicron droplet aerosols. As measured for water atomization, the produced droplets of *O*(200) nm in mean diameter are an order of magnitude smaller than 3-5 μm water droplets usually obtained from commercial atomizers and nebulizers. This reduction in droplet size promotes evaporation of solvent around two orders of magnitude faster than for the droplets produced by conventional atomization devices. Such rapid solvent evaporation enables formation of submicron particles even in the limit of room temperature drying conditions in a compact laboratory-scale setup, as we demonstrate in this study for sodium chloride and silica and titania xerogel particles. Ultra-fine diameters of the generated droplets enable the usage of more concentrated precursor solutions,

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