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Controlled formation of cyclopentane hydrate suspensions via capillary-driven jet break-up[1] MICHELA GERI, GARETH MCKINLEY, MIT — Clathrate hydrates are crystalline compounds that form when a lattice of hydrogen-bonded water molecules is filled by guest molecules sequestered from an adjacent gas or liquid phase. Being able to rapidly produce and transport synthetic hydrates is of great interest given their significant potential as a clean energy source and safe option for hydrogen storage. We propose a new method to rapidly produce cyclopentane hydrate suspensions at ambient pressure with tunable particle size distribution by taking advantage of the Rayleigh-Plateau instability to form a mono-disperse stream of droplets during the controlled break-up of a water jet. The droplets are immediately frozen into ice particles through immersion in a subcooled reservoir and converted into hydrates with a dramatic reduction in the nucleation induction time. By measuring the evolution of the rheological properties with time, we monitor the process of hydrates formation via surface crystallization and agglomeration with different droplet size distributions. This new method enables us to gain new insights into hydrate formation and transport which was previously hindered by uncontrolled droplet formation and hydrate nucleation processes.

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