

Controlled Synthesis of Silica Capsules: Taming the Reactivity of SiCl₄ Using Flow and Conditions

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Abstract: Monodisperse silica microcapsules are typically fabricated using hard templating methods. Though soft-templating methods are known, none yet provides a fast and easy method to produce monodisperse capsules. Herein, we describe a mesofluidic strategy whereby monodisperse droplets of reactive silica precursors are formed using a snap-off mechanism via a T-junction. Both the mesofluidic system and the composition of the reactive silica formulation are critical features. Using solid- and solution-state ²⁹Si-NMR, SEM, and optical microscopy, we have developed models for why some formulations form exploding capsules, why some capsules contain crystalline materials, and why some capsules have thin or thick walls.