

Fast and Minimal-Solvent Production of Superinsulating Silica Aerogel Granulate

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Silica aerogel superinsulation products have a tremendous growth potential, mainly for industrial and pipe insulation. However, the high production cost prevent the adoption of silica aerogel products outside of their established niche markets. A one-pot synthesis for silica aerogel granulate is presented that significantly decreases solvent use, production time, and global warming potential. The inclusion of the hydrophobization agent prior to gelation with a postgelation activation step, enables a complete production cycle of less than four hours at the lab scale for a solvent use close to the theoretical minimum. The one-pot aerogel granulate retains the exceptional properties associated with silica aerogel, mostly the thermal conductivity of $14.4 \text{ mW}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ for the pilot scale materials, about half that of standing air ($26 \text{ mW}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$).

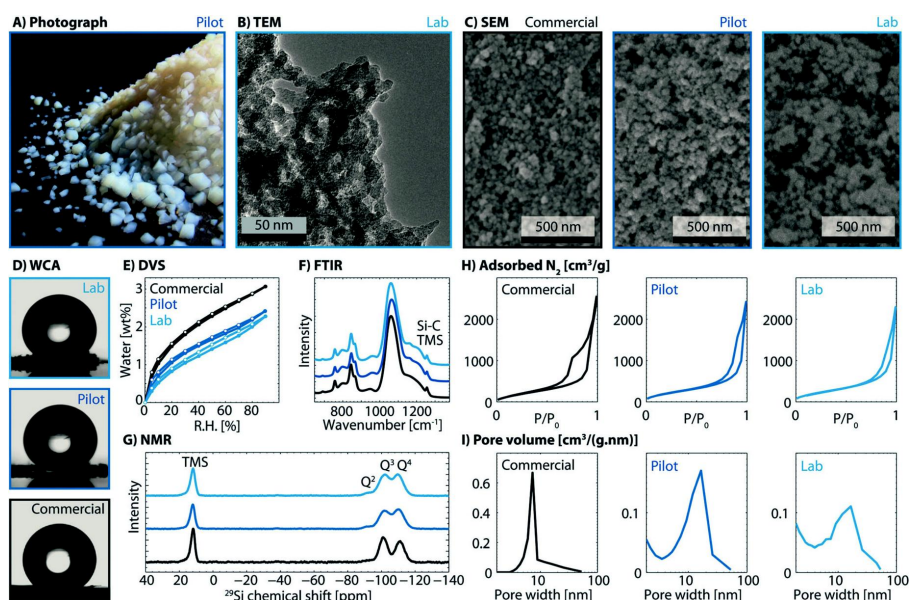


Figure 1. Structure, properties, and surface chemistry of one-pot and commercial aerogel. A) Photograph, B) TEM image, C) SEM images, D) water contact angle (WCA), E) dynamic vapor sorption (DVS), F) FTIR spectra, G) $1\text{H}-^{29}\text{Si}$ CP MAS NMR spectra, H) nitrogen sorption isotherms, I) pore size distributions.

[1] Lukas Huber, Shanyu Zhao, Wim J. Malfait *et al.*, *Angew. Chemie - Int. Ed.*, **2017**, 56, 1-5