



## Motivation

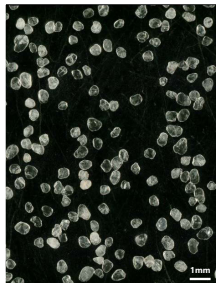
- **Thermal energy storage (TES)** enables concentrating solar power (CSP) to remain competitive and shows promise as a stand-alone long duration energy storage solution.
- As TES media, **silica sand particles demonstrate stability** over wide temperature range which allows for increased energy storage density and system improved economics.

## Summary

- Conducted review of silica thermophysical properties.
- Subjected silica particles to 500 hours at 1200°C under several atmospheres (air, humidified air, nitrogen).
- Cycled silica particles 25, 50, and 100 times between 300°C and 1200°C with 1-hour dwell times at extremes.
- Examined stability by means of pre- and post-treatment Mie scattering and XRD analysis.
- Results, indicating **limited changes in both particle distribution and crystallographic structure**, are promising for application as solid particle media for TES.

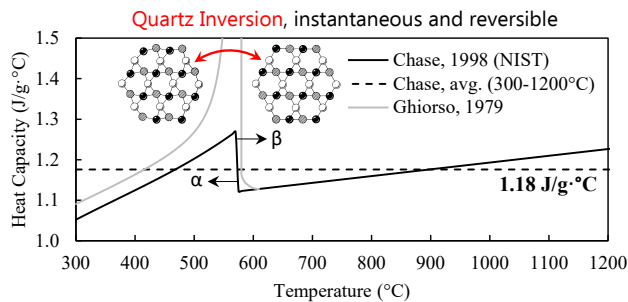
## Wedron Silica

- ✓ Abundant
- ✓ Inexpensive
- ✓ Energy Dense
- ✓ High Sphericity
- ✓ High Flowability
- Ⓞ High Stability

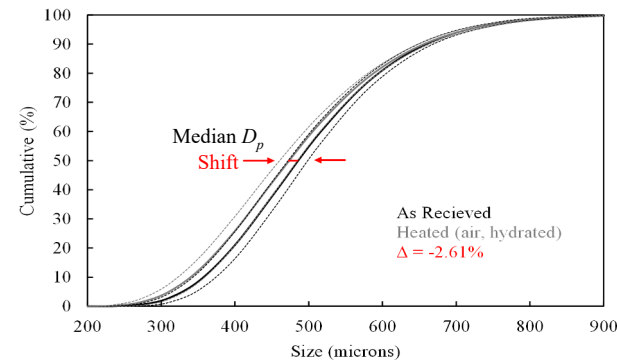


### Composition (%)

SiO <sub>2</sub>	99.65
Al <sub>2</sub> O <sub>3</sub>	0.065
Fe <sub>2</sub> O <sub>3</sub>	0.018
TiO <sub>2</sub>	0.011
CaO	0.012
Other	0.244

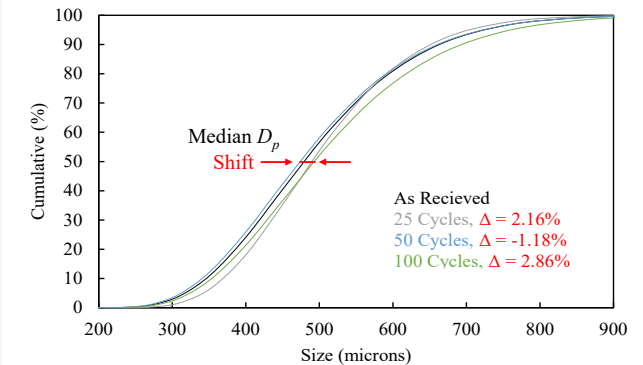


## Thermal Stability Test (under humidified air)

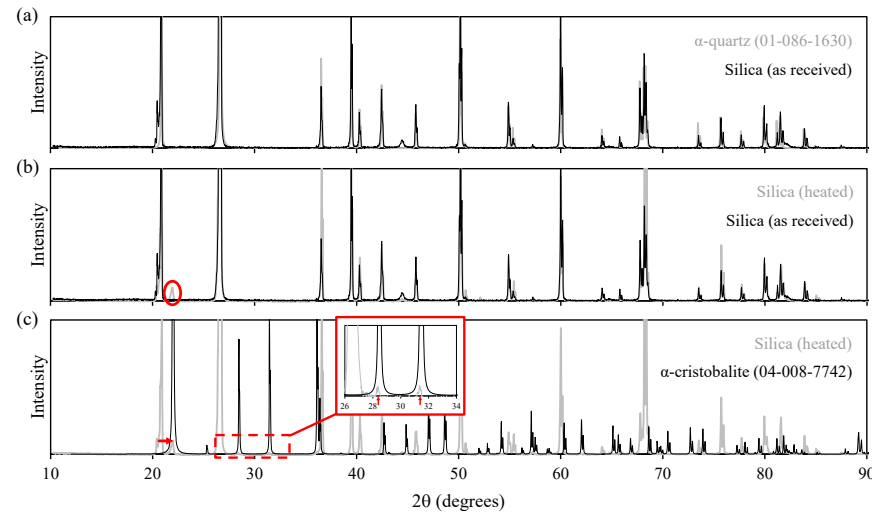


Particle distribution shift after 500-hour thermal treatment in humidified air (pH<sub>2</sub>O=50%) at 1,200°C. A -2.61% shift in median diameter (D<sub>x50</sub>) is observed, indicated by a red line.

## Thermal Cycling Test (air)



Particle distribution shifts after 25, 50, and 100 cycles (300-1200°C) relative to "as received" baseline for Silica 460. Distribution widens after 100 cycles but is not statistically significant.



(a) Overlay of "as received" XRD spectra and calculated  $\alpha$ -quartz PDF (01-086-1630) confirms high-purity of sourced silica; (b) overlay of "as received" and "heated" spectra show slight peak development at  $2\theta = 21.94^\circ$  and, to lesser extent,  $28.37^\circ$  and  $31.35^\circ$ ; (c) overlay of "heated" and calculated  $\alpha$ -cristobalite PDF (04-008-7742) identify peaks as cristobalite formation.

## Takeaways

- Silica subject to two different thermal treatments: 500-hour hold and cycling test.
- Exhibit limited changes in particle distribution and crystallographic structure
- Promising for application as solid particle TES media.
- **Complete results included in technical paper** (e.g. varied atmospheres).

