U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

SOLAR ENERGY TECHNOLOGIES OFFICE

SETO CSP Program Summit 2019

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THERMOPHYSICAL PROPERTY MEASUREMENTS OF HEAT TRANSFER MEDIA AND CONTAINMENT MATERIALS

Topic Area 2B: Gen3 Research & Analysis

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Thermophysical Property Measurements of

Heat Transfer Media
(e.g., Molten Salts)

&

Containment Materials
(e.g., high temperature alloys)

LIBRARY NEXT

Thermophysical Property Database

HEAT LAB

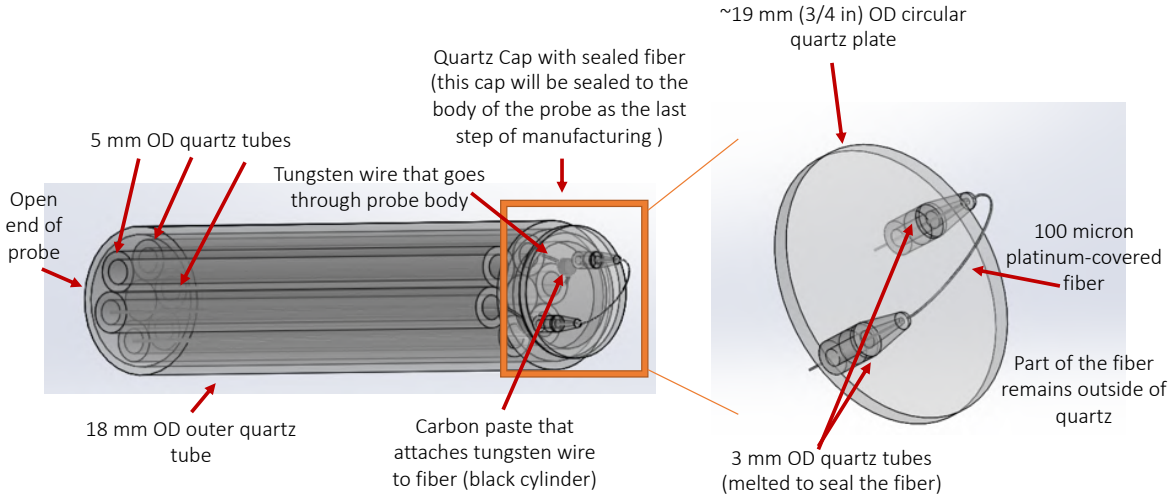
Immersion Electrothermal Probe

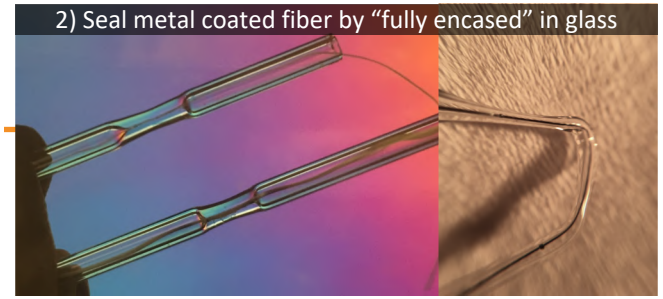
HEAT LAB

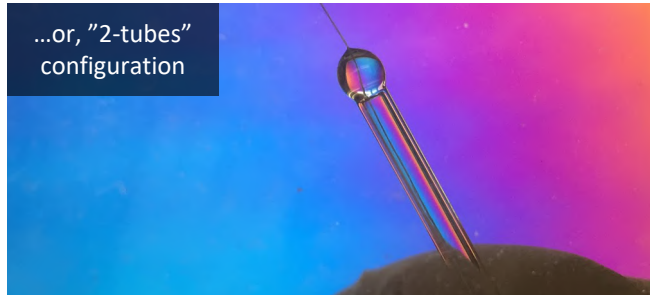
Advanced Photo-thermal Technique

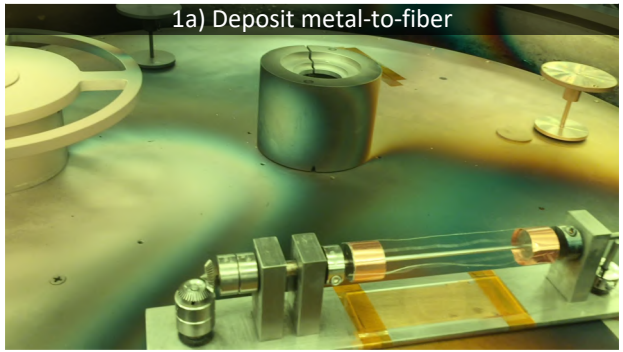
Measurement Accuracy at High Temperatures in Corrosive Environments

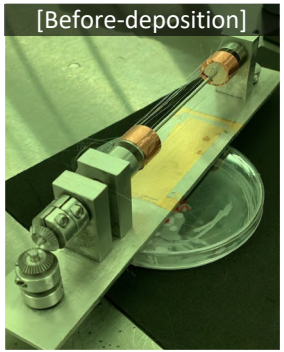
Latest Design of Immersion Probes

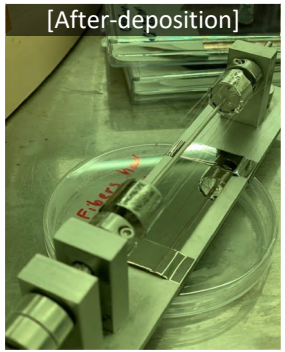


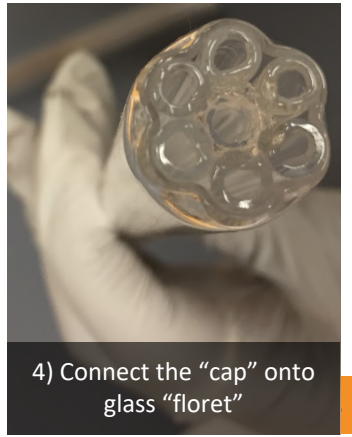




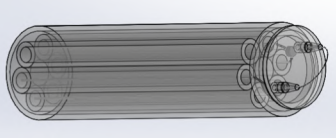


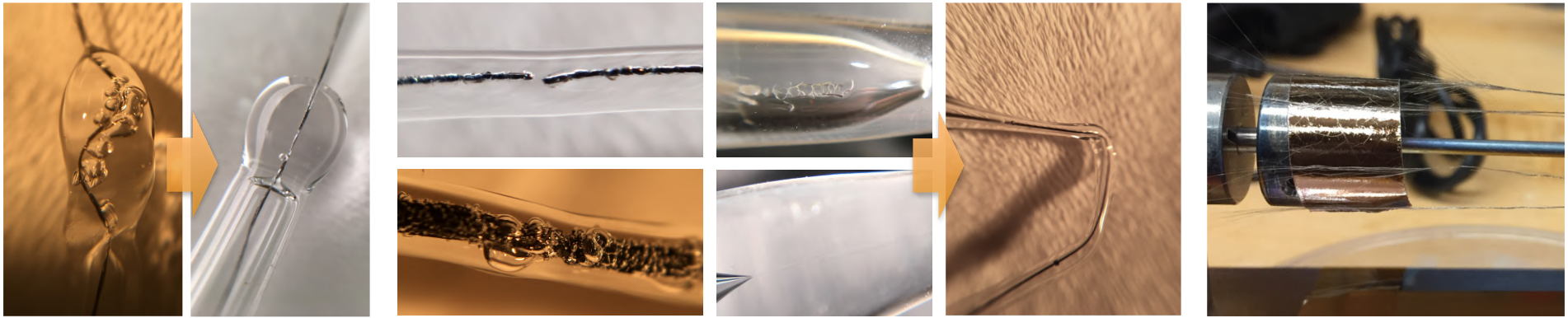






Key Technical Challenges and Solutions





- Solutions: Next round of prototypes will be a linear combination of heater line and sealing methods in each column

	Lower Temperatures (< 800 °C)	Higher Temperatures (> 800 °C)
	Borosilicate and Platinum	**Quartz and Molybdenum**
Heater Line	Ceramic fiber with Pt coating	Ceramic fiber with Mo coating
Heater Line	Silica fiber with Pt coating	Mo wire
Sealing Method	Fully encased	Fully encased
Sealing Method	2-tubes	2-tubes

Innovation and Impact

Steady-state techniques	Transient techniques (time domain)	Transient techniques (frequency domain)
1D reference bar (ASTM D5470)	Transient hot-wire (THW)	3-omega
Radial heat flow method	Time-domain thermoreflectance	Frequency-domain thermoreflectance
Guarded hotplate (ASTM D1518)	Laser flash method	Pulsed power technique
DC thermal bridge method	Transient plane source	

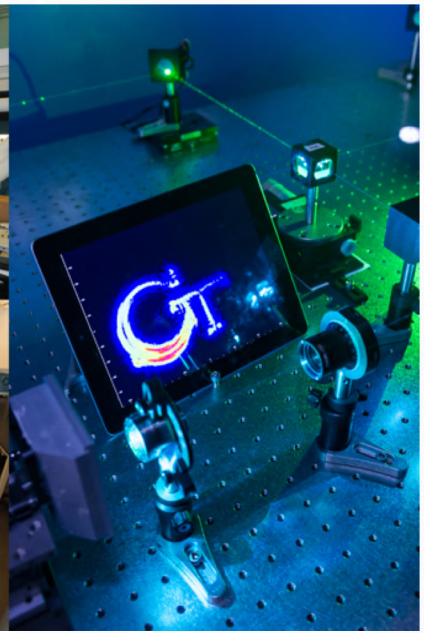
- Proposed electrothermal immersion probe sensor can become the standard characterization technique at temperatures >700 ^{o}C
  - *Addresses key challenges present in current state-of-the-art techniques*
- The modified Xenon flash technique could serve to benchmark high temperature characterization of solids
  - *Versatility - its can be useful for other high temperature applications*

Project Team & Facilities

- Bettina K. Arkhurst (Grad student)
- Sonja Brankovic (Grad student)
- Andrey Gunawan (co-PI)
- Shannon K. Yee (PI)
- Scalable Thermal Energy Engineering Laboratory
- HEAT LAB (heat.gatech.edu)

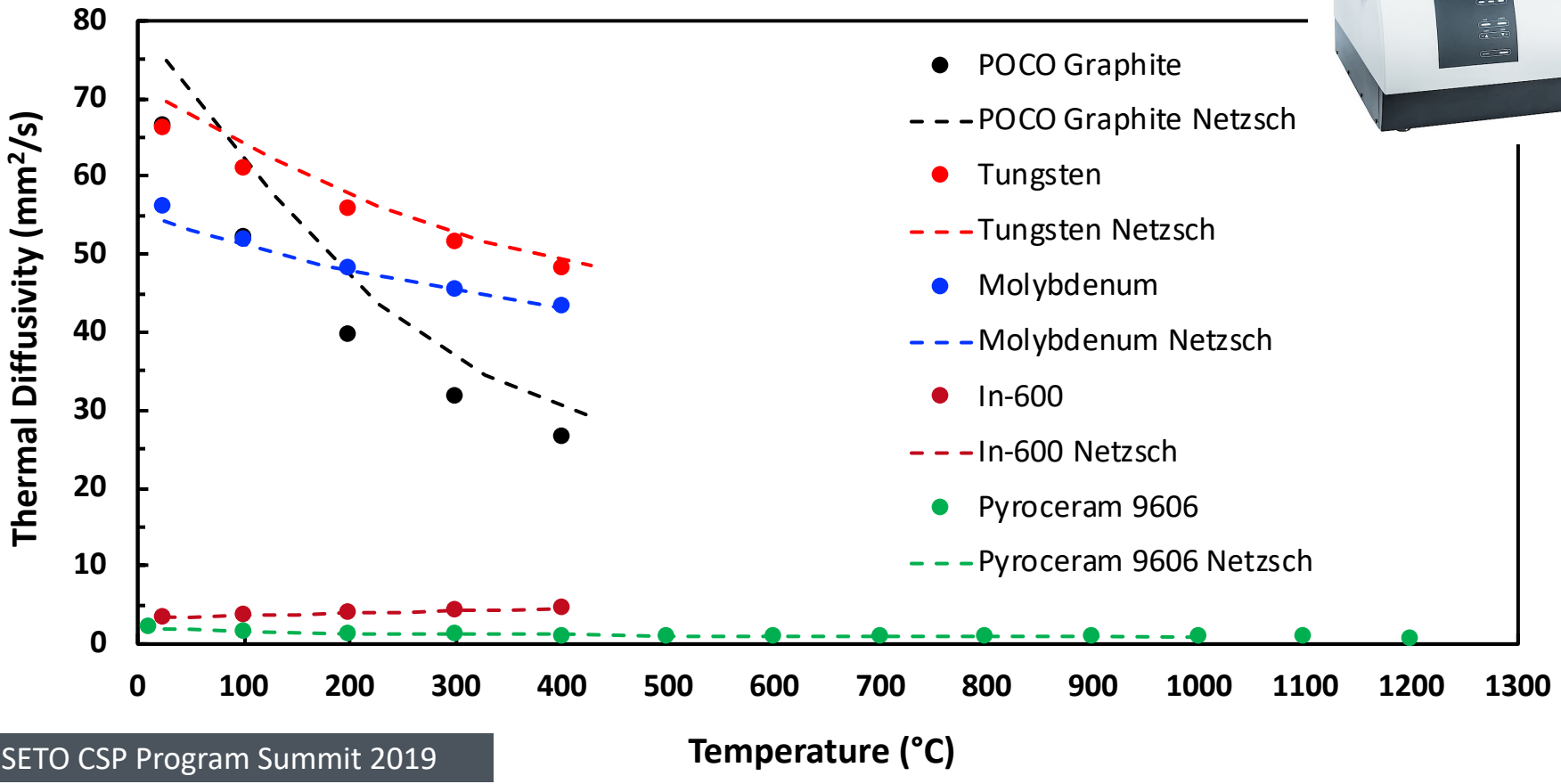




Additional slides

Preliminary Thermal Diffusivity Dataset of NIST Standards



In-House Probe Leadscrew Mechanism