Analysis of Carbon Bearing Materials for Use as First Wall Armor in the HAPL Chamber

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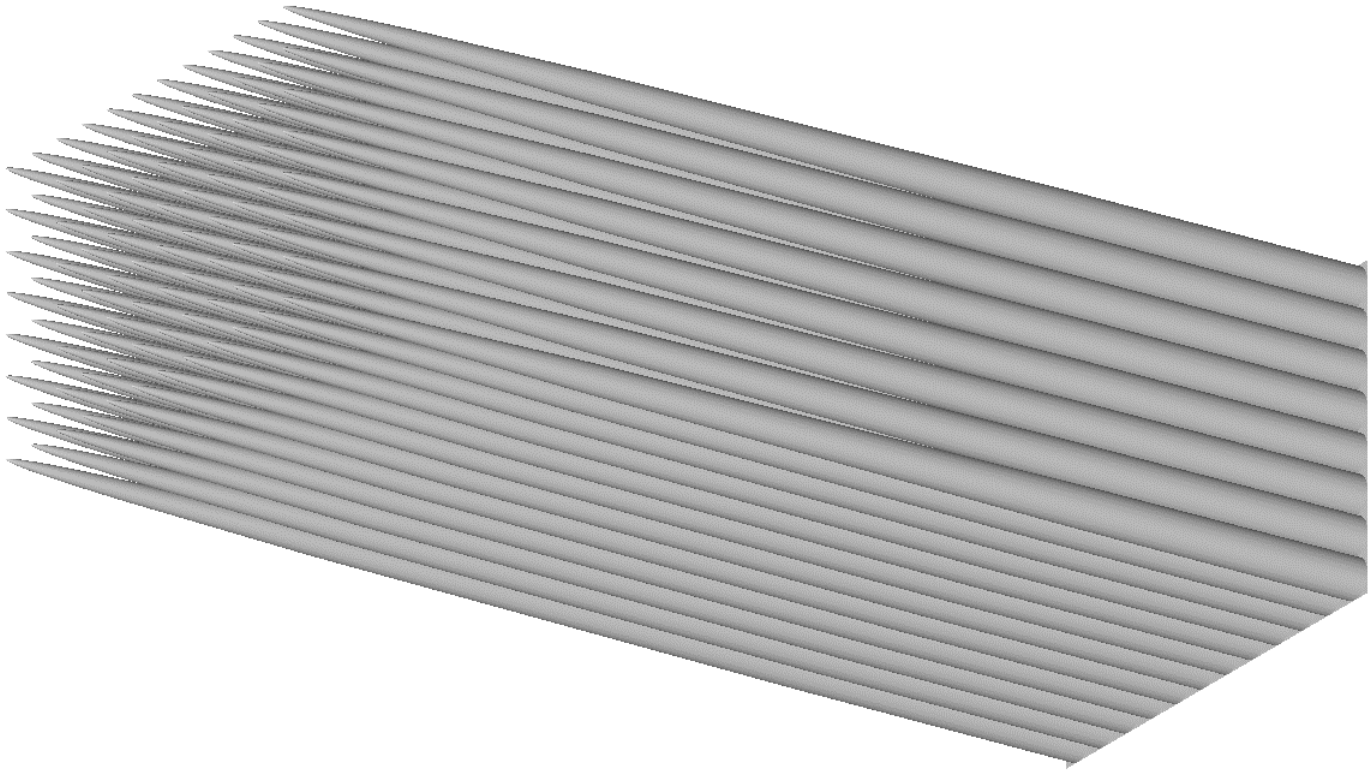
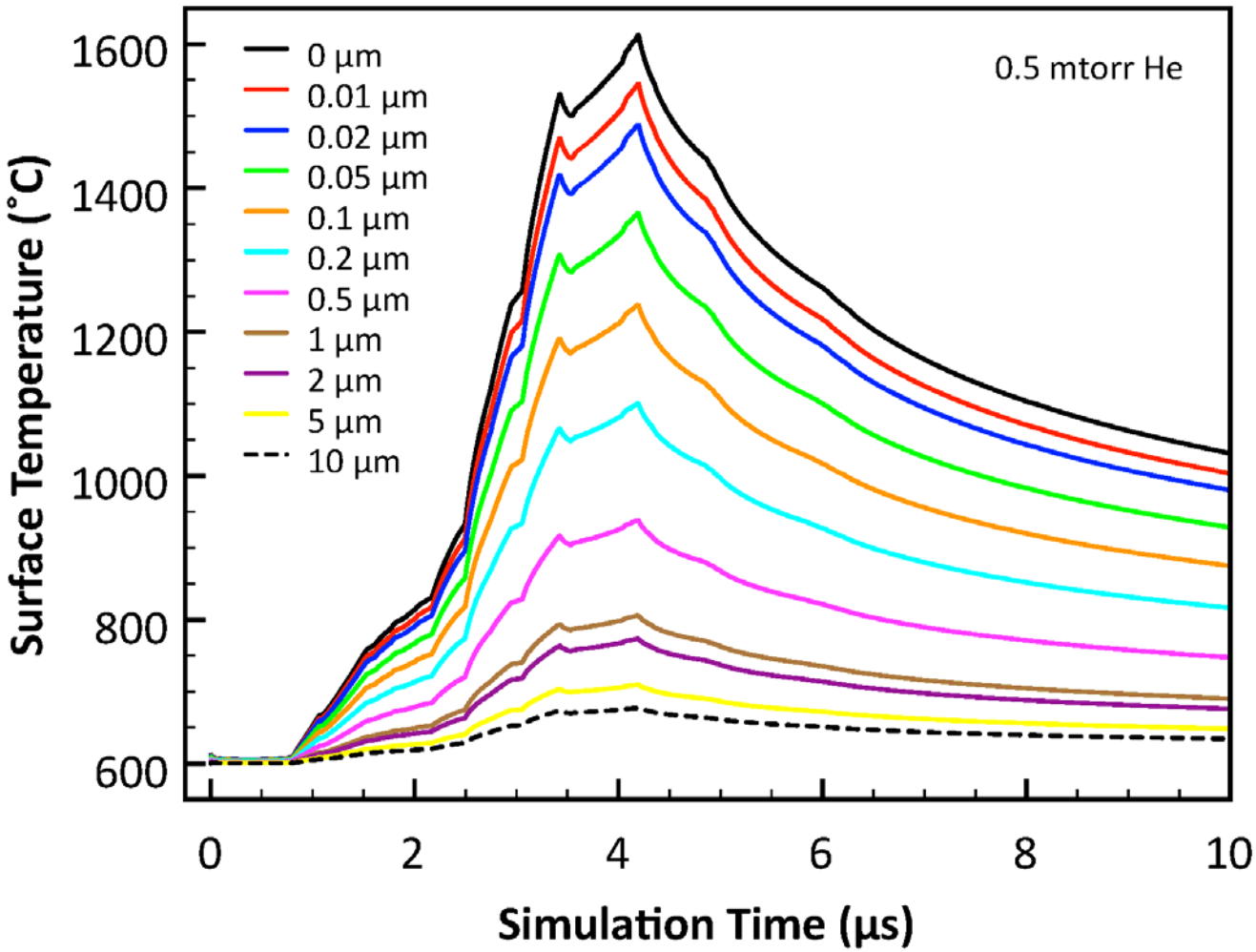
Results since last HAPL Meeting

- More extensive thermal transport simulations of carbon fibers
- Single wall carbon nanotube material analyzed
- Included temperature limits on all carbon-based simulations
- Erosion rates computed

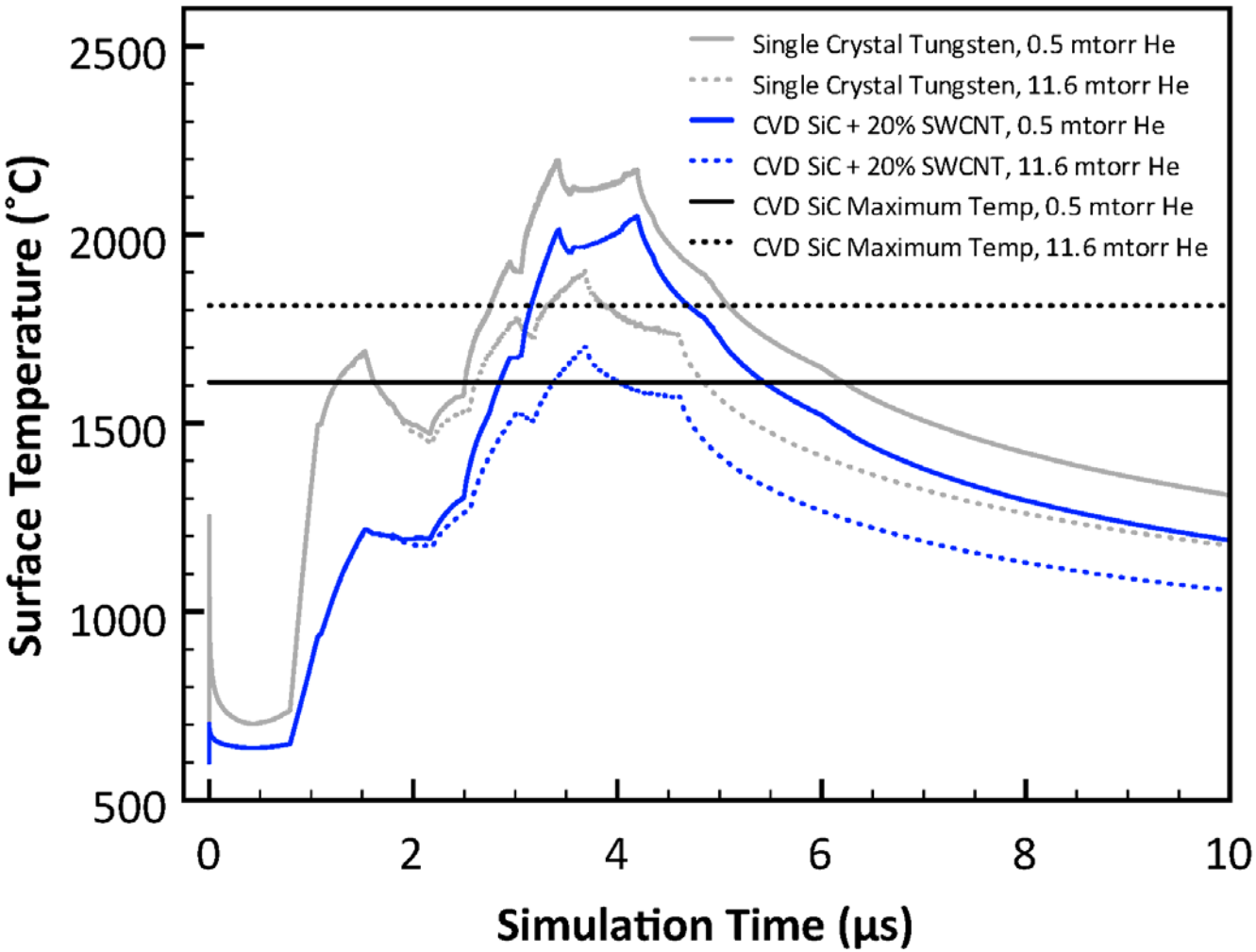
Carbon needles



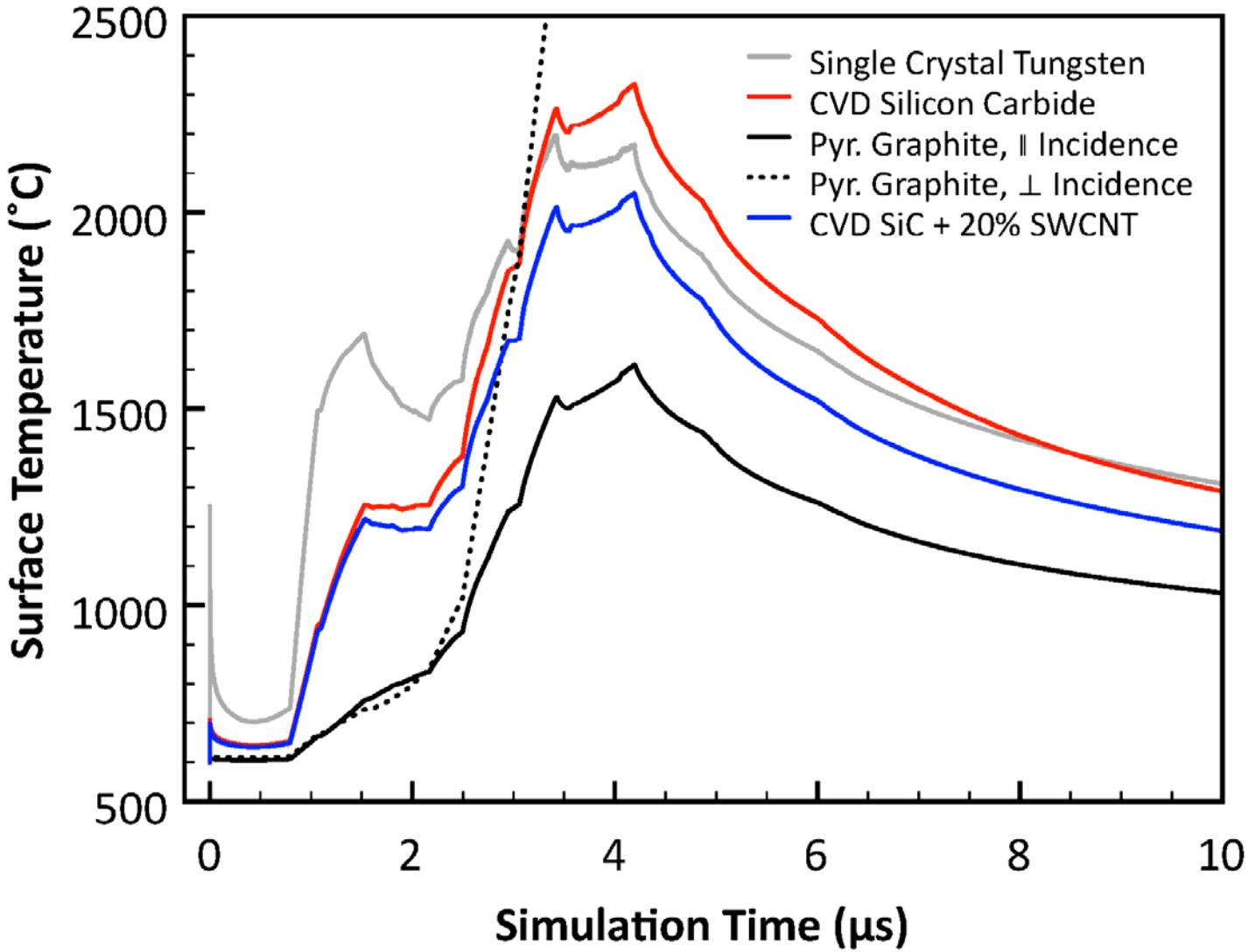
Temperature rise at points along needle



Carbon nanotube surface temperature rise



Surface temperature rise for all carbon bearing materials



Estimated Armor Erosion Rates

Armor Material	0.5 mtorr He			11.6 mtorr He		
	Temperature Limit (°C)	Maximum Temperature (°C)	Erosion Rate (μm/FPY)	Temperature Limit (°C)	Maximum Temperature (°C)	Erosion Rate (μm/FPY)
Tungsten	2400	2201	—	2400	1905	—
CVD Silicon Carbide	1609	2327	0.779	1812	1916	0.00625
Graphite, planes ∥ to threat spectra	2408	1613	—	2695	1302	—
Graphite, planes ⊥ to threat spectra	2408	4220	3090	2695	3076	20.9
CVD SiC + 20% SWCNT	1609	2050	0.0564	1812	1705	—

Summary

- All of the simulated materials, except the graphite with planes aligned perpendicular to threat spectra, had acceptable erosion rates.
- From a thermal standpoint, both tungsten and carbon materials are suitable as armor with small amounts of He chamber gas.