

September 20, 2024

High-Temperature carbon fibers ablation in 4D



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Seminar Details

*Friday, September 20,
2024 2:30pm – 4:00pm*

*UH Campus
Classroom & Business
Building
Room CBB 104*

*Online via Teams [https://
www.cive.uh.edu/
research/beyer-
distinguished-lecture](https://www.cive.uh.edu/research/beyer-distinguished-lecture)*

ABSTRACT: AHigh-Temperature gas-material interactions are critical processes in the development of hypersonic flight systems for space exploration and national defense. to be safe and effective throughout the extreme conditions of re-entry, designs must anticipate and be robust to changes in the aerodynamic shape and surface roughness due to ablation and oxidation. Hand-in-hand with the development of computational capabilities has been a need for data to both validate models and identify key physical mechanisms.

This talk will focus on multi-scaled experiments on carbon fibers, the backbone of thermal protection materials for hypersonic flight. We will discuss how X-ray imaging at high resolution ahas become an invaluable tool to understand and quantify the response of porous materials subjected to extreme conditions. The core of the talk will focus on novel synchrotron light source experiments on carbon fibers where the ablation phenomenon is resolved in 4D, at high temperature, using real-time X-ray micro-tomography. From the high spatial and temporal resolution scans we were able resolve asymptotic regimes in carbon oxidation occurring at different flight conditions, from reaction-limited regime. These data constitute the basis for predictive modeling tools for carbon ablation and high speed vehicle design.

BIOGRAPHY: Dr. Francesco Panerai is an Assistant Professor in Aerospace Engineering at the University of Illinois at Urbana-Champaign. His research covers advanced materials for extreme environments, transport in porous media, and hypersonic aerothermodynamics. Prior to Illinois, environments, he was a research scientist at NASA Ames Research Center. He received his PhD and Research Master in Aeromatics and Aerospace from von Karman Institute for Fluid Dynamics in (Belgium) and a M.Ss. and a B.Sc. in Mechanical Engineering from the University of Perugia (Italy). He is one of the founding ember of the Center for Hypersonics and Entry Systems Studies (CHESS) at the University of Illinois.