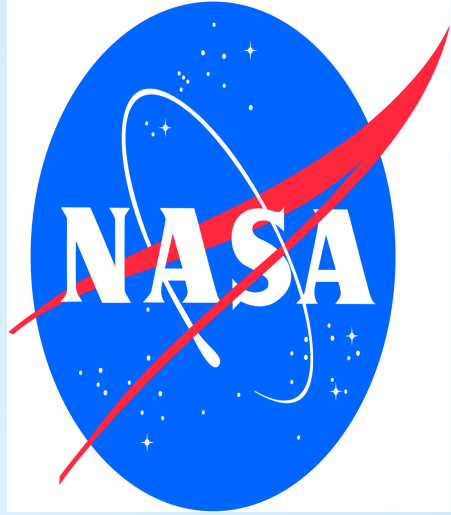


Quantified Physical and Chemical Characterizations of PM Emission From Jet Gas Turbine Engine With Conventional (JP-8) and Synthetic (HRJ & FT) Fuels

Chung-Hsuan Huang & Randy Vander Wal

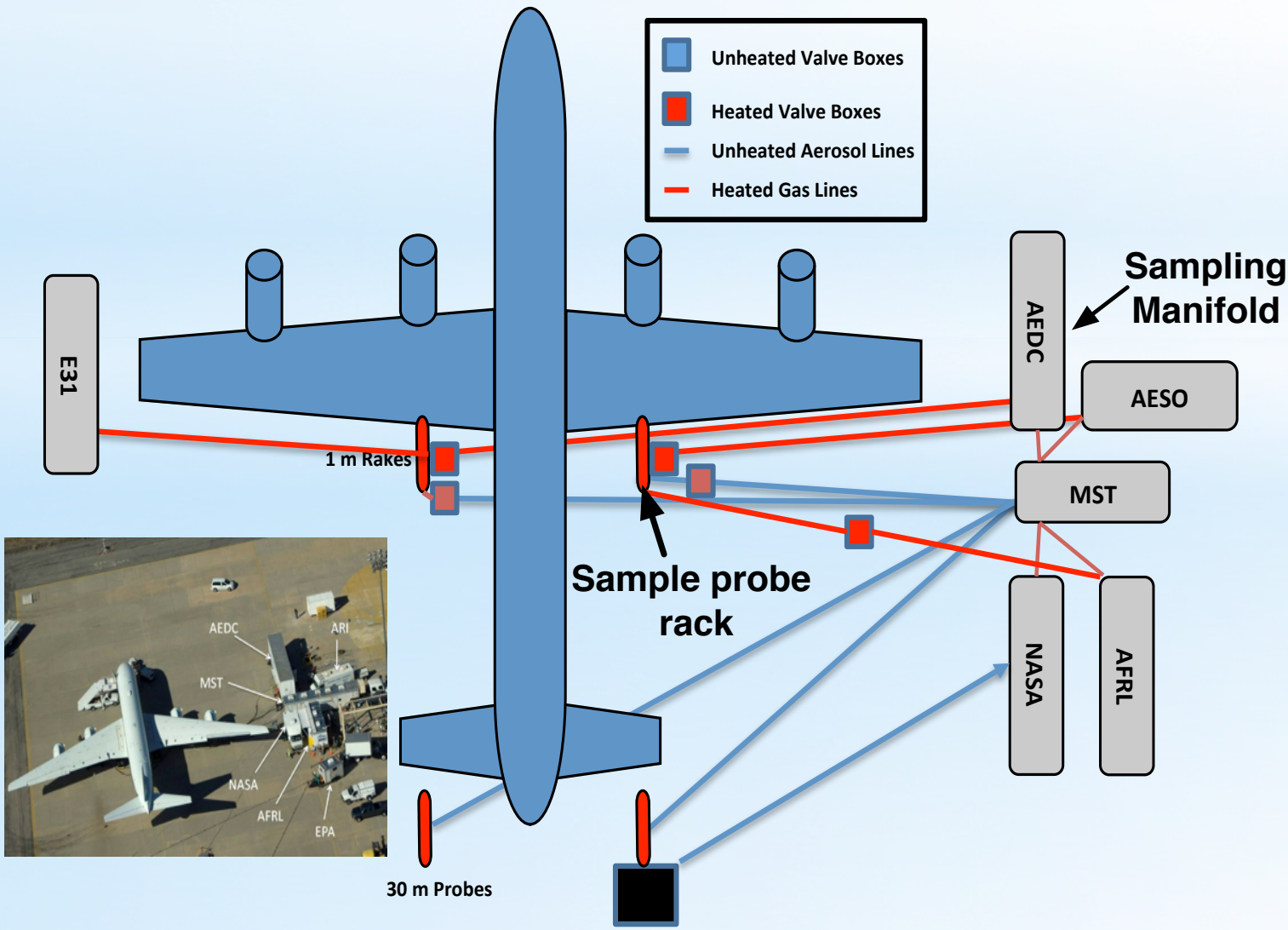
¹John and Willie Leone Family Department of Energy and Mineral Engineering and The EMS Energy Institute at The Pennsylvania State University, State College, Pennsylvania 16802



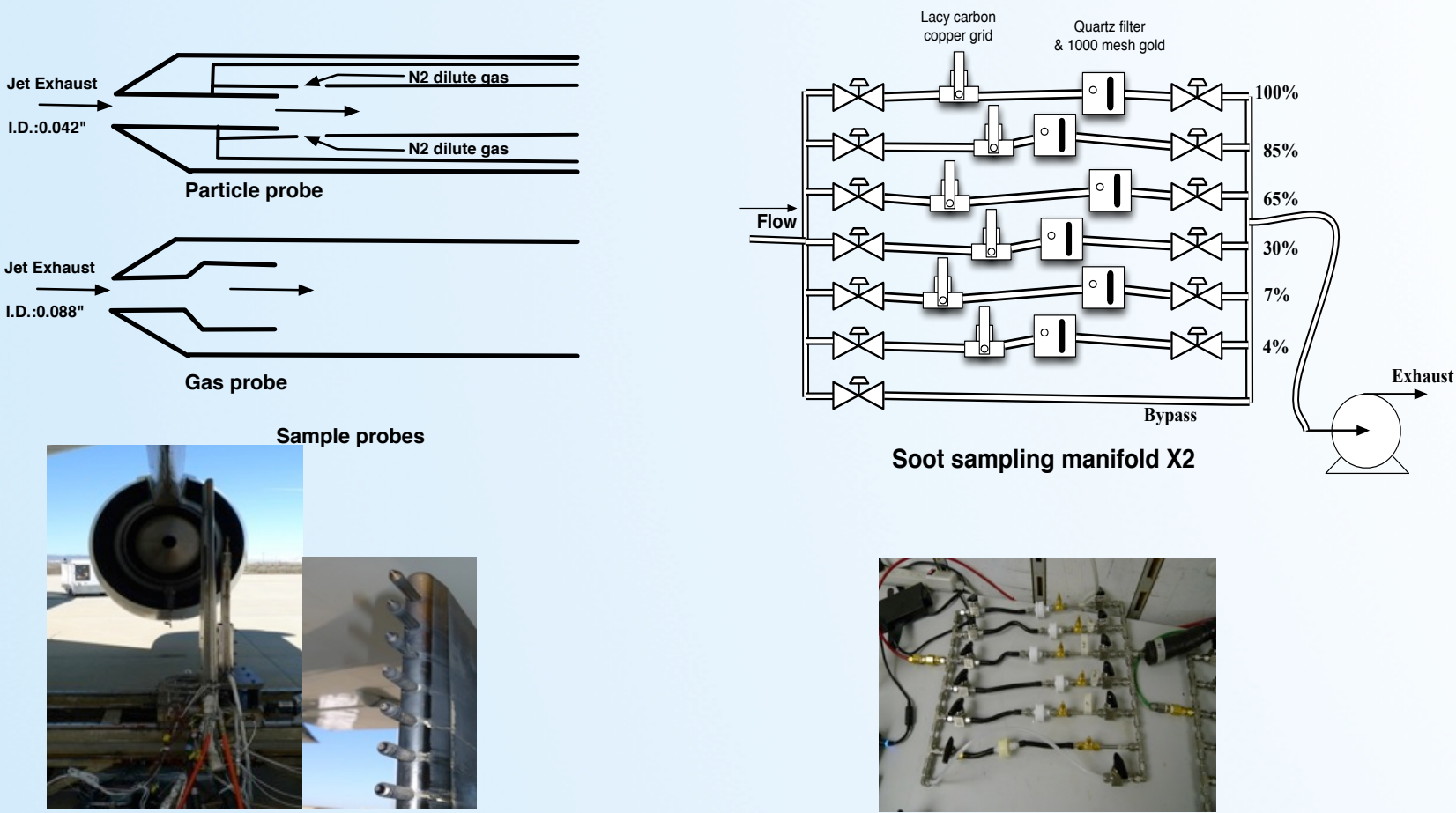
Introduction

- ✧ To evaluate soot *physical* nanostructure and *chemical* composition (C-C sp² & sp³ bonding state) evolution as varied by
 - (1) fuel dependence
 - (2) power condition
 - (3) gas turbine engine type
- ✧ 3 fuels tested : JP-8, HRJ & FT
- ✧ Soot was produced by a CFM56-2C3 engine across power level ranging from 4%-100% corresponding to idle, taxi, cruise, and take off.

Experimental Set Up

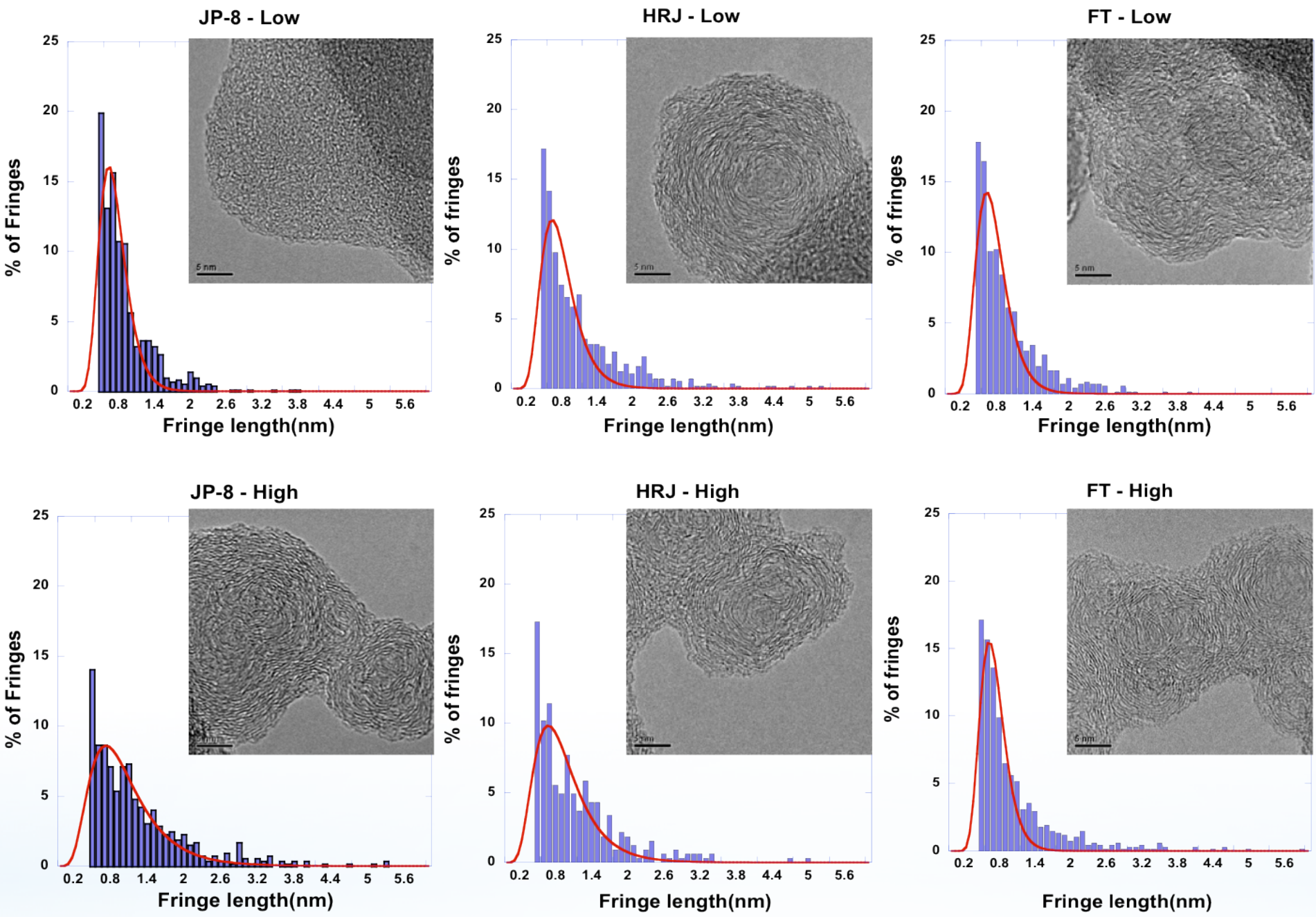


Sampling Probes & Manifold

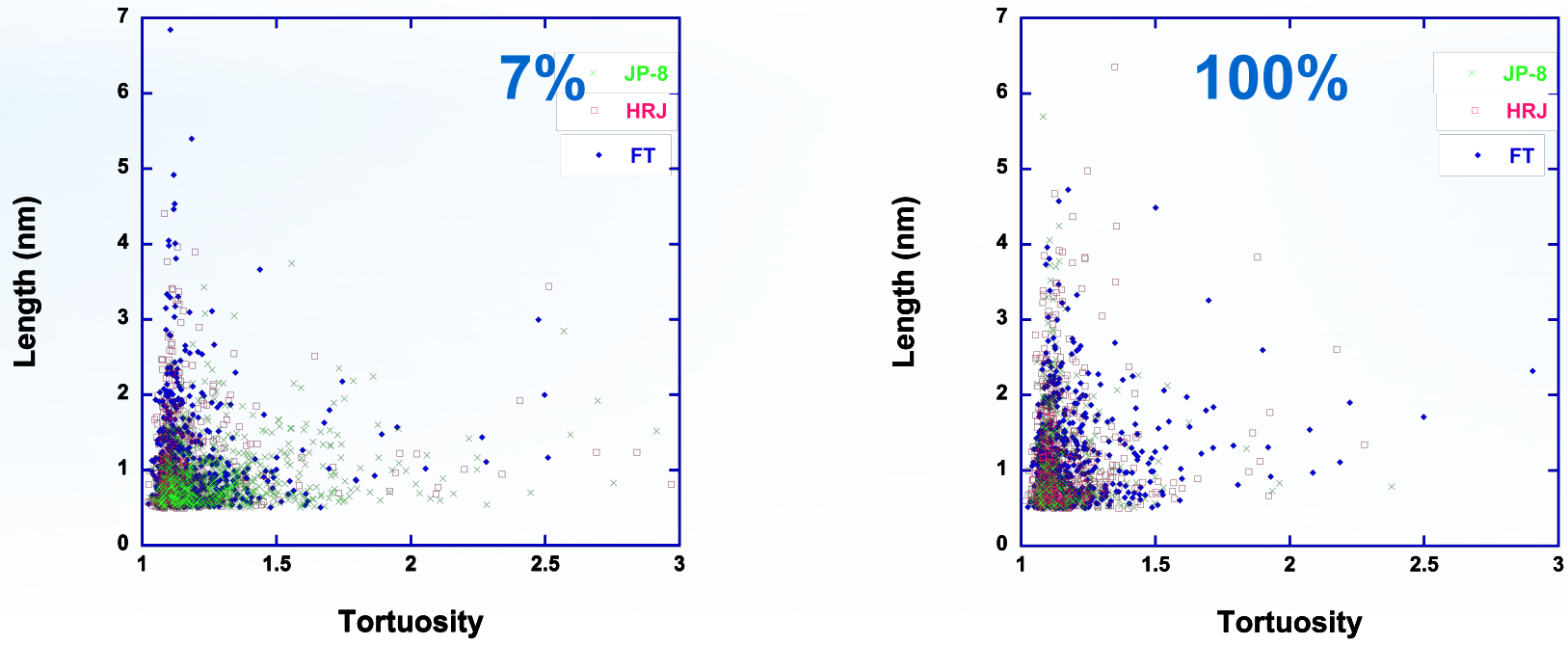


Physical Characterizations

Nanostructure & Quantification

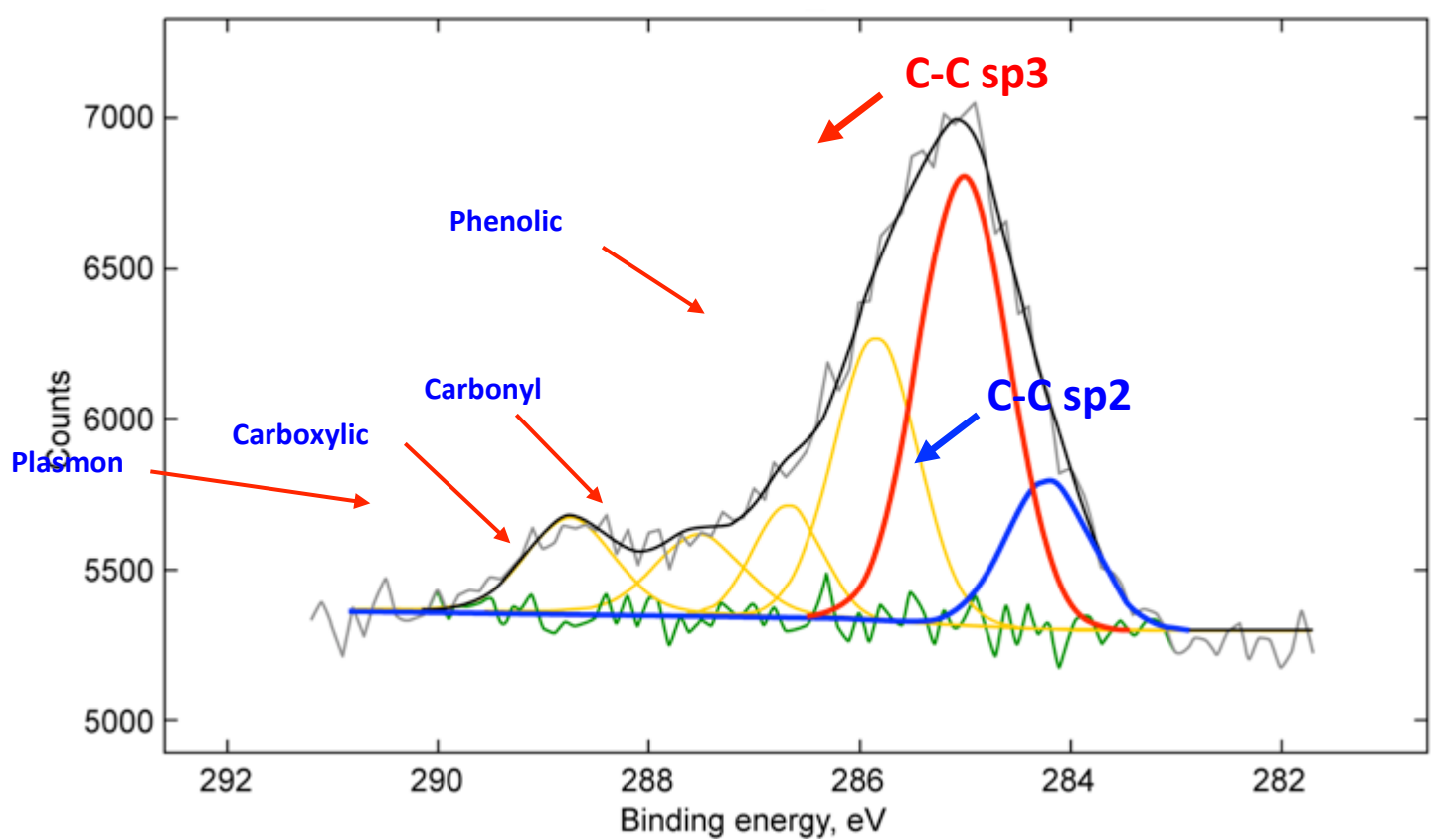


Lamella distribution: Length vs. Tortuosity

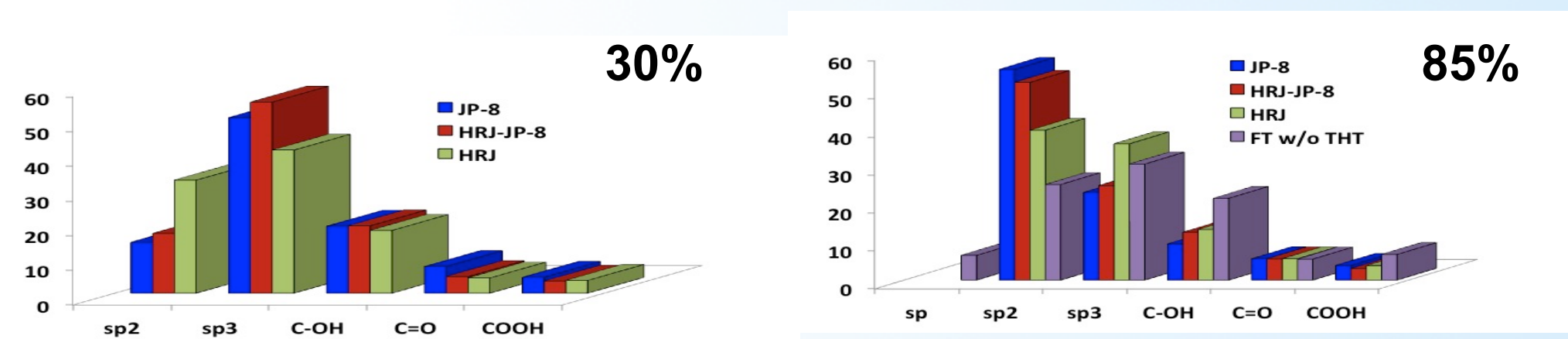


Chemical Characterizations

XPS: Carbon C1s Region & Peak Deconvolution



Summary of Carbon C1s Region Deconvolution



Summary

Physical Nanostructure

- ✧ JP-8 soot: Nanostructure evolves as a function of engine power.
- ✧ HRJ & FT soot: Similar nanostructure found across all power levels.

Chemical Characterization

- ✧ XPS results indicate the organic content of soot.
- ✧ sp²/sp³ ratio indicates JP-8 soot has high organic carbon at low power level and high elemental carbon at high power; HRJ & FT has similar degree of elemental carbon at both low and high power levels corresponding to the nanostructure quantification analysis.

Acknowledgement

The author gratefully acknowledges the overall AAFEX II project coordination and experimental assistance and support by Dr. Bruce Anderson (NASA-Langley). Vicky M. Bryg (USRA) is acknowledged for TEM and XPS contributions and Dr. Edwin Corporan (WPAFB) for graciously sharing his experimental data prior to publication. Support for this work was through the NASA Aeronautics Subsonic Fixed Wing (SSFW) Program, NASA Cooperative Agreement NNX09AD42A with The Pennsylvania State University, at University Park PA.

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