

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

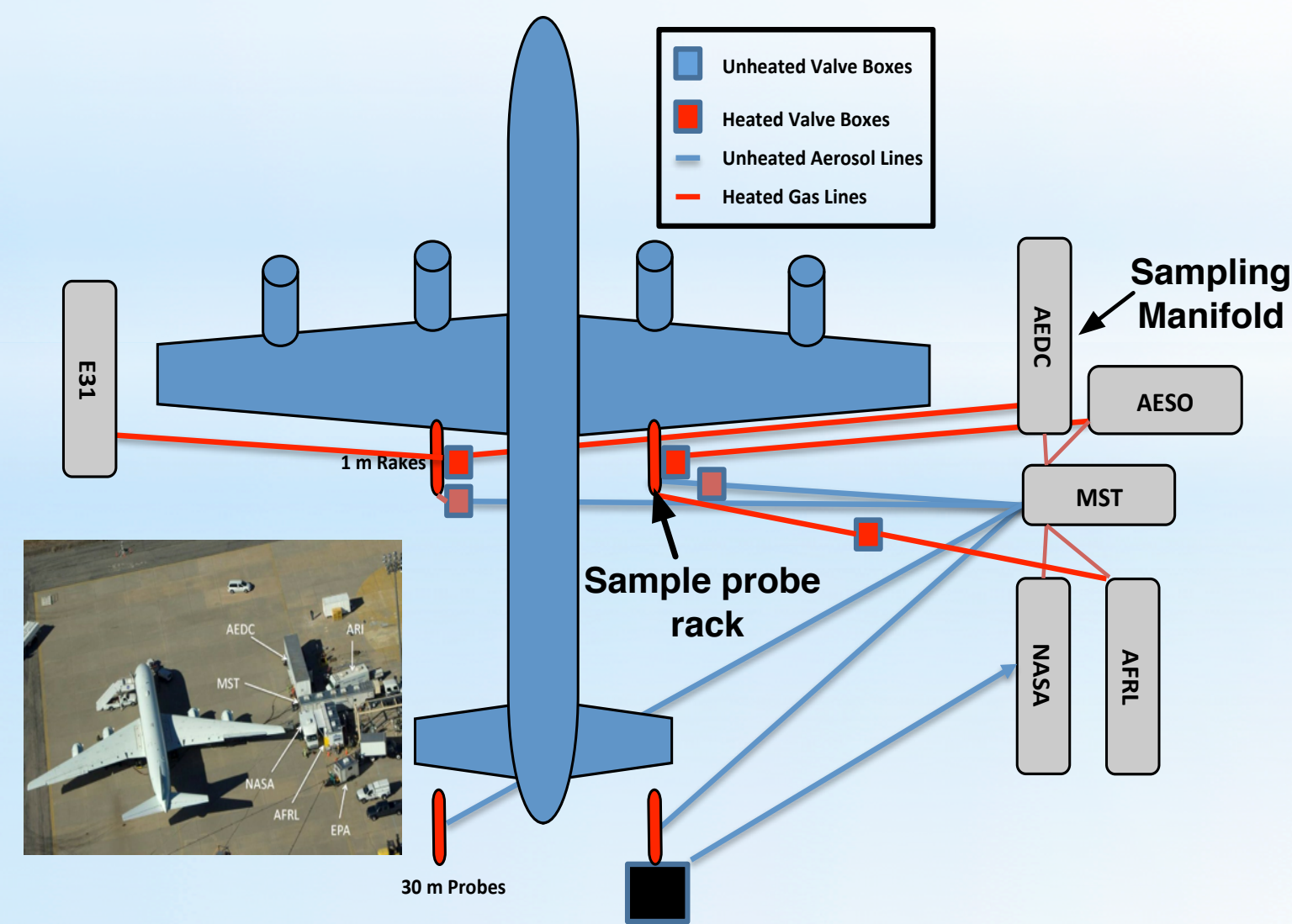
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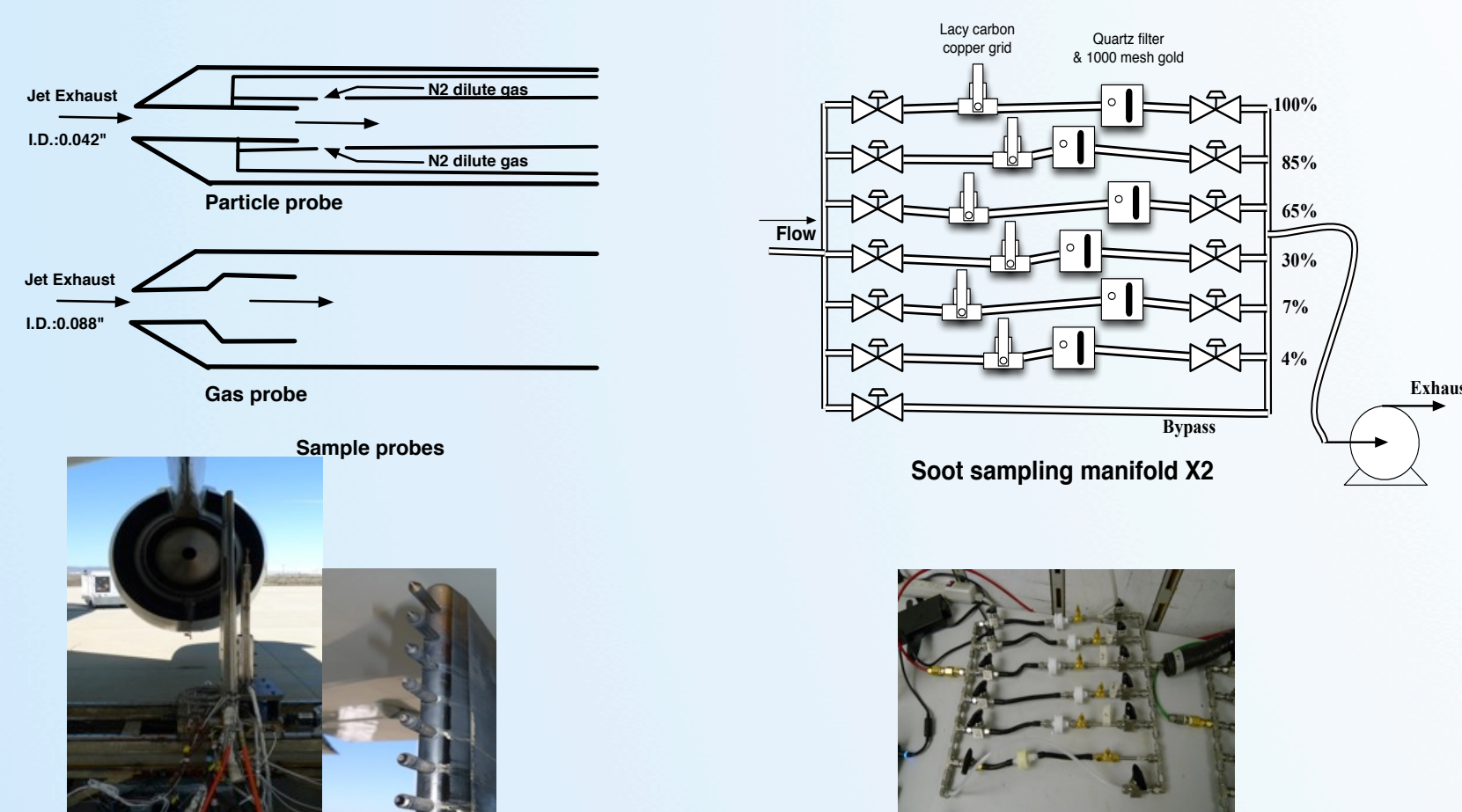
Introduction

- 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

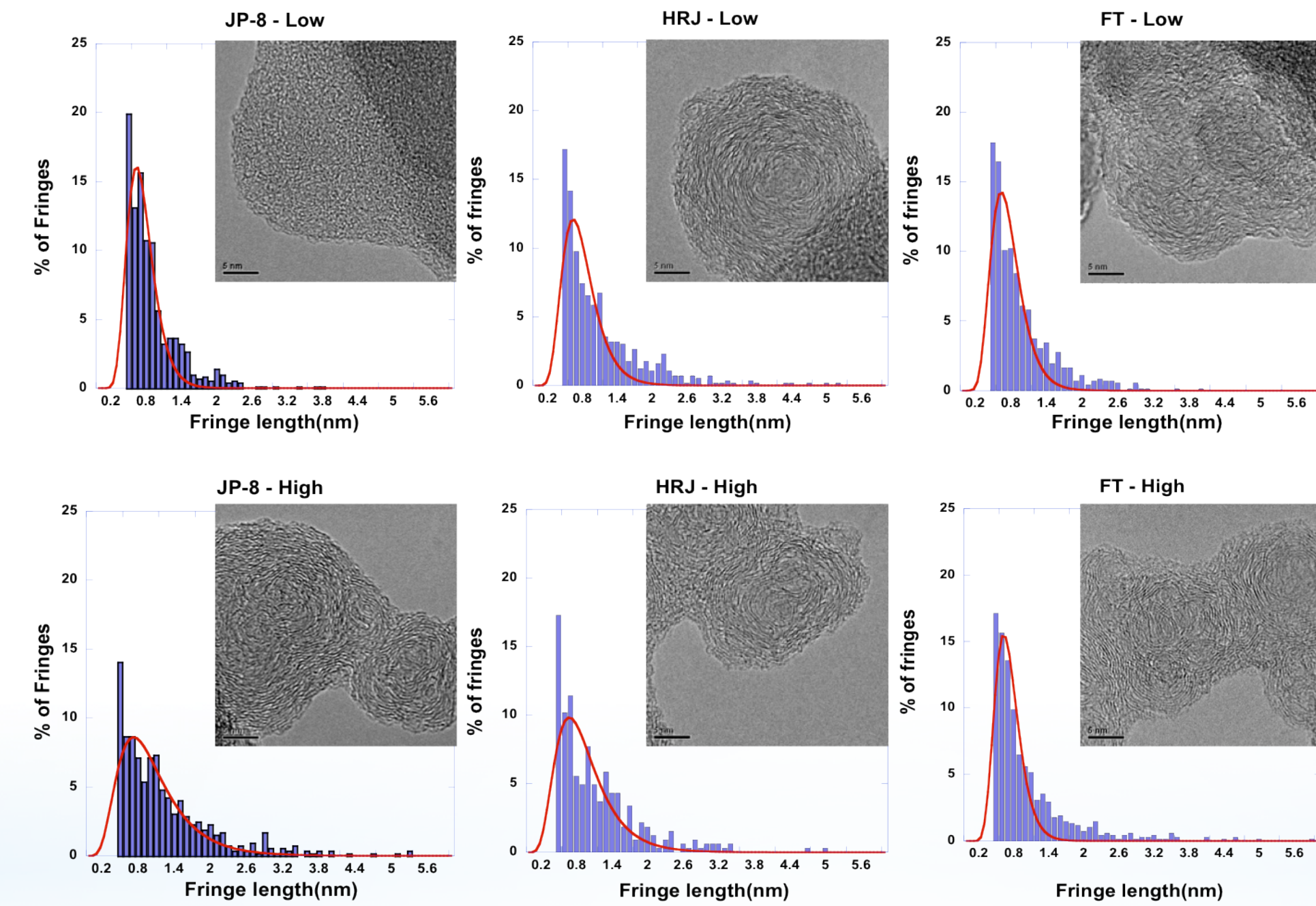


Sampling Probes & Manifold

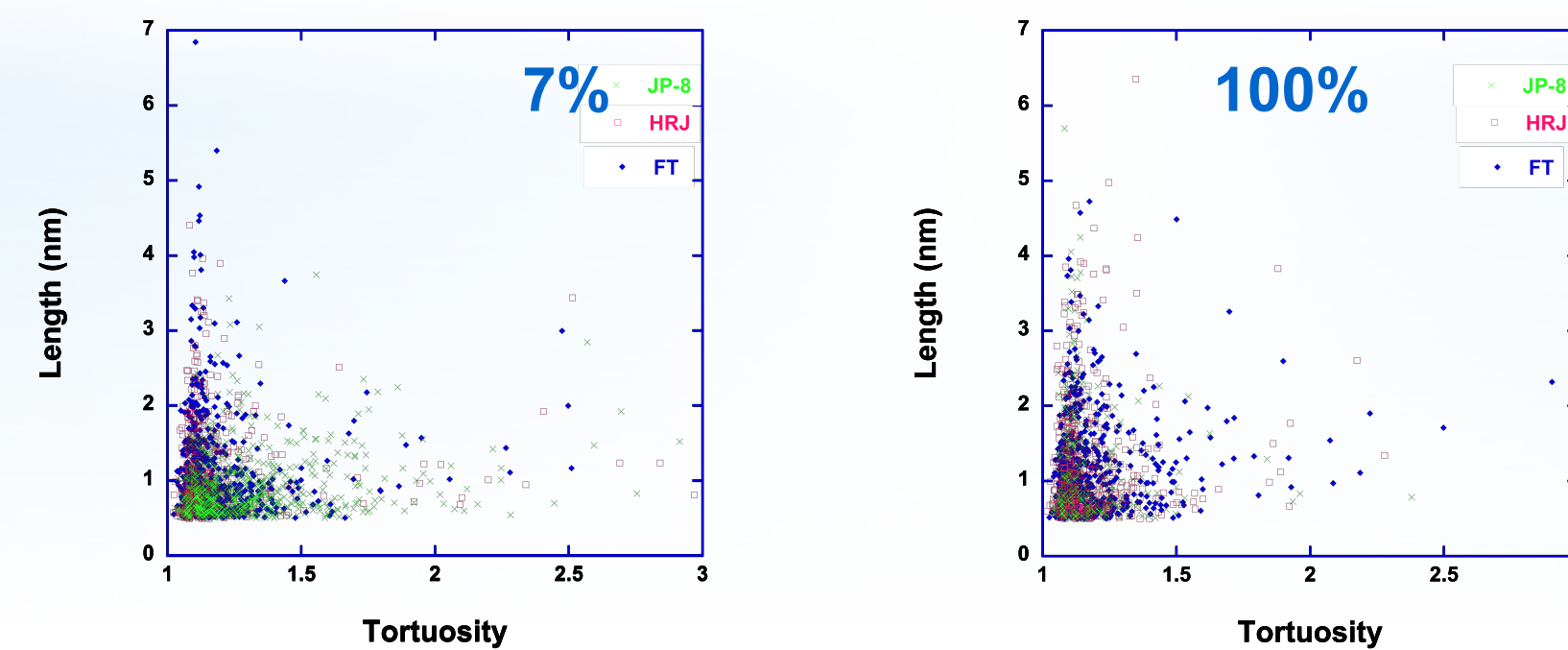


Physical Characterizations

Nanostructure & Quantification

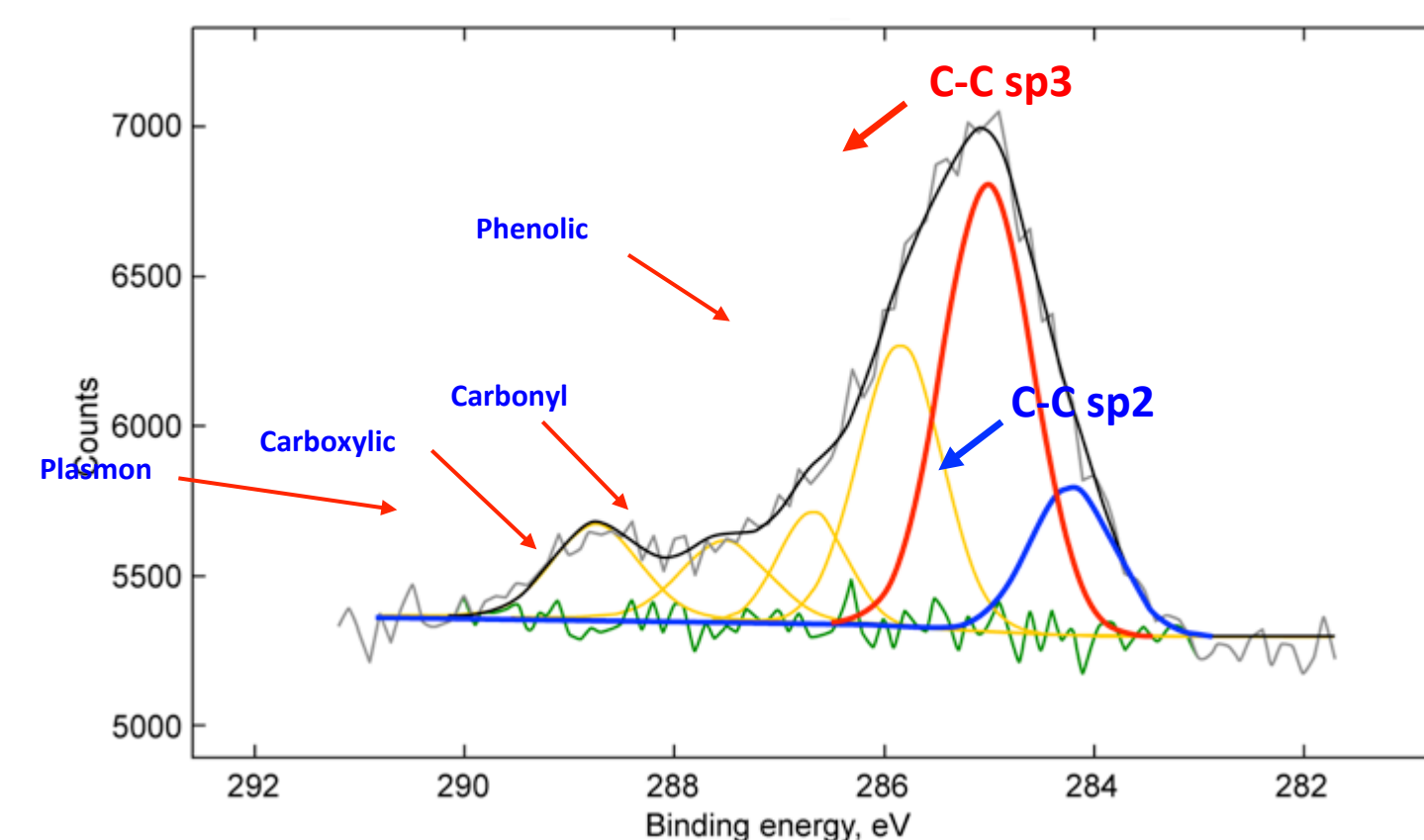


Lamella distribution: Length vs. Tortuosity

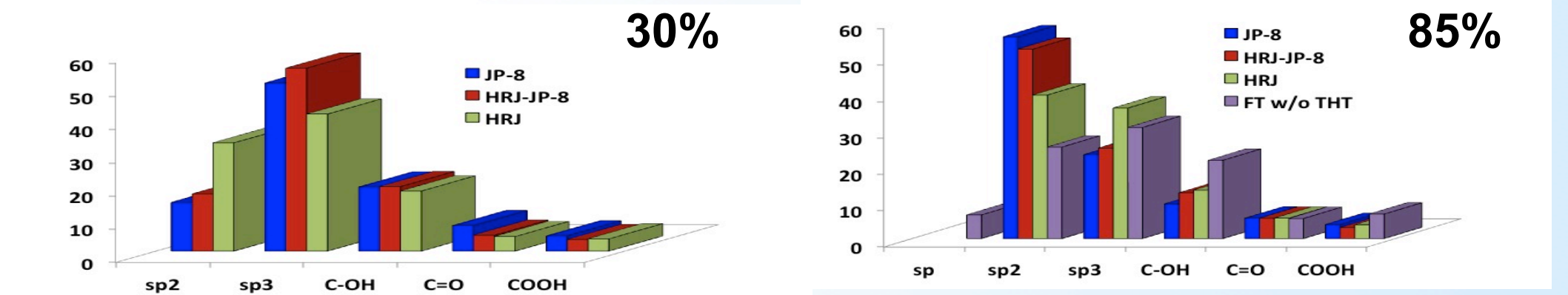


Chemical Characterizations

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

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Reference

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