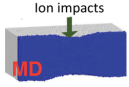
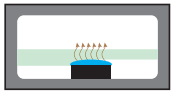
Focused Ion Beam (FIB)

Measure: products scattered from C/SiC or SiC or similar samples; **vary:** impact temperatures and species, target material, microstructure, *etc.*; **use:** finite-rate oxidation model closure and validation; **models:** corresponding MD simulations, 0D closure of GSI reaction kinetics; **status:** shared-use FIBs at Illinois, experience using FIB with MD simulations and continuum modeling.

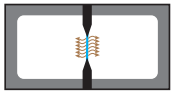


Furnace: Flow

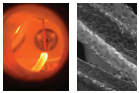


Measure: interface mass spectroscopy of products, PLIF; **vary:** materials (graphite, PAN carbon fibers, C/SiC, SiC, ...), temperature, pressure, gas (O_2, H_2, H_2O, air, CO_2, C_2H_4, *etc.*); **use:** quantify passive structural degradation (SEM, EDX, XRD microscopy); **models:** 1D surface evolution transport and kinetics; **status:** furnaces and mass spectrometers on campus (MRL), experience in team with measurements and model closure.

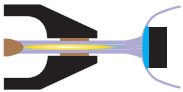
Furnace: Stress



Measure: oxidation rate, O distribution with atom-probe tomography (APT), geometric evolution, strength, stress-coupling; **vary:** materials (graphite, PAN carbon fibers, C/SiC, SiC, ...), temperature, pressure, gas (O_2, H_2, H_2O, air, CO_2, C_2H_4, *etc.*); **use:** quantify passive strength degradation; **models:** 1D surface oxidation and strength coupling; **status:** furnaces with stress-strain capabilities on campus (MRL), experience in team with measurements and model closure.

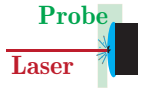


Plasmatron Ablation

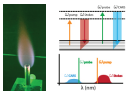


measure: in-situ PLIF of near-surface reactants and products; **vary:** materials, temperature, pressure, gases; **use:** quantify structural degradation under extreme aerothermal conditions simulating combustor flow conditions; **models:** 1D/2D-axi surface evolution with flow; **status:** PI with experience from NASA Ames, extensive PLIF systems available at Illinois, anticipated plasmatron ready on-site early 2020.

Laser Ablation



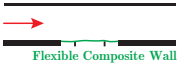
Measure: ultrafast diagnostics of transient products; **vary:** target material, temperature, pressure, gases; **use:** transient response validation; **models:** 1D/2D-axi surface transport/kinetics models; **status:** experience with fs diagnostics and laser methods, especially laser-induced breakdown (LIB).



Jet Mixing, Ignition and Propagation

Measure: mixing & evolution of ignition kernel with emission spectroscopy, PLIF; **vary:** fuels, flow conditions; **use:** validation for mixing, combustion kinetics, ignition; **models:** 2D-axi or 3D jet combustion simulations (short time for TIK); **status:** based on current LIB and transient ignition kernel (TIK) configurations and corresponding models; **variant:** add axisymmetric flame holder for prediction flame-holding limits.

Flexible/Rough Surface Supersonic Wind Tunnel



Measure: wall deflection and T, PIV, FLEET, high-speed schlieren; **vary:** flow conditions, materials, material roughness; **use:** mechanical models, flow-structure interaction models; **models:** 2D analog; 3D for simple geometry turbulence studies; **status:** on-campus wind tunnels with flow and surface measurement diagnostics operated by the PIs.