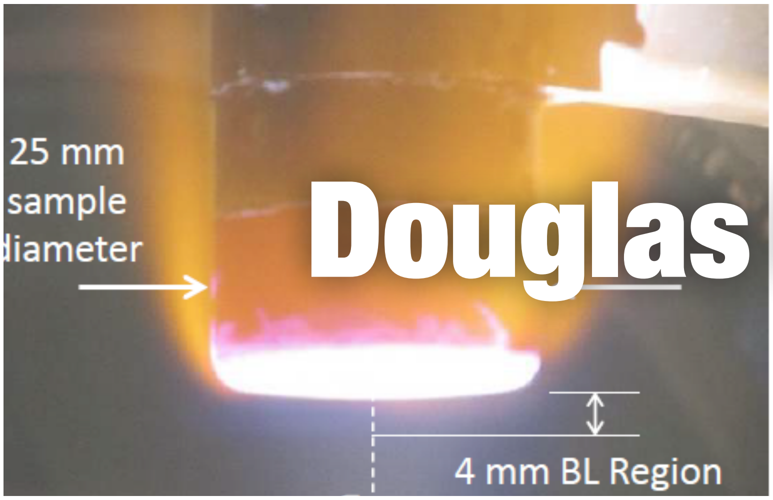
AES Seminar



Douglas Fletcher

Professor, Mechanical Engineering, University of Vermont

Recent Developments in High Temperature Gas-Surface Interaction Investigations

Thursday, Jan. 24 | DLC | 12:00 P.M.

Abstract: Significant progress has been made recently in the application of laser-spectroscopic measurement techniques to diagnose the non-equilibrium reacting layer over a material exposed to trajectory-relevant, stagnation-point plasma heating environment. Recent tests in the University of Vermont 30 kW Inductively Coupled Plasma (ICP) Torch Facility have provided the first direct measurements of surface reaction rates from diffusion gradient measurements at trajectory-relevant test conditions. These results are based on two-photon Laser-Induced Fluorescence (LIF) measurements of the reactive atomic species fluxes arriving at the material surface. Using different plasma gas mixtures it is possible to understand and resolve competing surface reaction measurements, and this is demonstrated by comparing surface-catalyzed reaction efficiencies for air, oxygen, and nitrogen plasma test conditions. Present work is aimed at developing a more quantitative measurement of the surface reaction products. While surface-catalyzed reaction efficiency measurements show the utility of the diagnostic approach, additional efforts are underway to diagnose carbon nitridation rates and interactions between pyrolysis gases and plasma species in the near-surface region.

Bio: Douglas Fletcher is a Professor of Mechanical Engineering at the University of Vermont. He earned a BS in Engineering from the University of Vermont, and an MS in Mechanical Engineering and PhD (1989) in Mechanical and Aerospace Engineering at the University of Virginia (UVa) under the supervision of Prof. James McDaniel. Dr. Fletcher joined the Experimental Fluid Dynamics Branch at NASA Ames Research Center (ARC) to develop laser diagnostic techniques to measure turbulent flow fluctuations in high-speed, compressible flows. He later moved to the Reacting Flow Environments Branch to lead efforts to characterize plasma flows in large-scale arc-jet facilities by using a single laser-spectroscopic technique to quantify the kinetic, thermal, and chemical energy of the free stream.