Abstract Submitted
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A Composition-Independent Thermometry Technique for Gaseous Mixtures in Reacting Environments[1] DOMINIC ZELENAK, Graduate Student, VENKAT NARAYANASWAMY, Assistant Professor, WILLIAM SEALY, Undergraduate Student, TURBULENT SHEAR FLOW LABORATORY TEAM — Temperature is an important thermochemical property that holds the key to uncovering several combustion phenomena such as pollutant formation, flame extinction, and heat release. In a practical combusting environment, the local composition is unknown, hindering the effectiveness of established non-intrusive thermometry techniques. This study aims to offset this limitation by developing a laser-based thermometry technique that does not require prior knowledge of the local composition. The Turbulent Shear Flow Laboratory (TSFL) at North Carolina State University is currently using a combination of krypton planar-laser induced fluorescence (Kr-PLIF) and Rayleigh scattering to measure temperature in reacting environments. Initial work by TSFL has studied Kr-PLIF lineshape properties of several combustion species to obtain scaling for the collisional broadening parameters based upon the properties of Kr and the surrounding environment. This information will be used to demonstrate the mean temperature profile of a 1D lean premixed CH_4 flame exhaust at different downstream distances with multiple equivalence ratios for a wide range of temperatures and local compositions. Validation of the proposed technique will be made using Rayleigh scattering temperature measurements.

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