APPLICATION OF COHERENT ANTI-STOKES RAMAN SCATTERING THERMOMETRY IN TURBULENT AND LAMINAR FLAMES

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Coherent anti-Stokes Raman scattering (CARS) is a non-linear spectroscopic combustion diagnostic technique used for measurement of temperature and species concentration. Broadband CARS spectra can be acquired with a single laser shot with high spatial and temporal resolution. We present two distinct applications of a nanosecond dual-pump vibrational CARS system. The first experiment aimed to study the effect of simulated exhaust-gas-recirculation, via addition of CO_2 to the fuel stream, on the flame structure of lean CH_4-air pilot-assisted turbulent premixed flames. For this experiment over 20,000 single-shot spectra were acquired and spectrally fitted to develop a detailed temperature map of the flame flow-field. In the second experiment, laminar flames with varying soot loading were stabilized over a "Yale burner". This burner, in the combustion community, is a canonical system for the development of soot models. The principal challenge in this experiment was obtaining a CARS signal with an adequate signal to noise ratio in the presence of strong soot-emission background. Our measurements in both experiments will serve as benchmark data for the development of combustion computational models.