

DEVELOPMENT OF COMBINED DUAL-PUMP VIBRATIONAL AND PURE-ROTATIONAL COHERENT ANTI-STOKES RAMAN SCATTERING TECHNIQUE.

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Coherent anti-Stokes Raman scattering is a parametric, four-wave mixing process. CARS, as a diagnostic technique, has been used extensively for obtaining accurate temperature and species concentration information in non-reacting and reacting flows. Dual-pump vibrational CARS (DPVCARS) can provide quantitative temperature and concentration information on multiple species in the probe volume. Mole-fraction information on molecules such as N₂, O₂, H₂ and CO₂ have been obtained in flames with peak temperature in excess of 2000 K. Although DPVCARS provides high accuracy at higher temperatures it has low sensitivity at lower temperatures (below 800 K). Typically, pure-rotational CARS (PRCARS) provides excellent sensitivity and precision at lower temperatures. We have combined DPVCARS and two-beam PRCARS into a single system which employs three laser beams at different wavelengths. The accuracy and precision of the new combined CARS system has been characterized in laminar flames. The system's single-shot precision is better than 5.5 % between 295-2200 K, indicating its suitability for diagnostics in turbulent flames. The new system has been applied towards understanding flame structure of CH₄/H₂/air laminar flames, stabilized in a counter-flow burner. Here, we present results detailing the development and application of the new combined CARS technique.