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Development of Combined Dual-Pump Vibrational and Pure-Rotational Coherent Anti-Stokes Raman Scattering (DPVCARS and PRCARS) System

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ABSTRACT

Coherent anti-Stokes Raman scattering (CARS) [1,2] is a spatially-resolved, time-resolved spectroscopic technique for quantitative measurements in reacting flows [3 – 6]. This work demonstrates a combination of $N_2/O_2/CO_2$ dual-pump vibrational coherent anti-Stokes Raman scattering (DPVCARS) system and two-beam pure-rotational coherent anti-Stokes Raman scattering (PRCARS) system. It is based on the previous development of combined VCARS and PRCARS system which was used to obtain temperature measurements in non-premixed H_2 -air flames. The new combined system will be used to measure the temperature profiles and major species concentrations such as $N_2/O_2/CO_2$ in laminar counter-flow non-premixed (CH_4/Air) and partially-premixed ($CH_4/H_2/Air$) flames. The new system is being characterized in H_2/Air diffusion flames stabilized over a Hencken burner. CO_2 will be added to the oxidizer stream for the system to assess the precision of the system while performing concentration measurements. The new combined system has shown good precision temperature using PRCARS (better than 3%) and N_2/O_2 mole-fraction ratio (better than 5%) using DPVCARS.

KEYWORDS

Laser spectroscopy, combustion, nonlinear optics, Coherent anti-Stokes Raman scattering

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