SPONTANEOUS RAMAN SCATTERING MEASUREMENTS OF NITROGEN VIBRATIONAL DISTRIBUTION FUNCTION IN NANOSECOND PULSED DISCHARGE

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Fundamental energy storage and transfer characteristics of nanosecond pulsed, non-equilibrium discharge plasmas is an area of continuing interest. These discharge environments have a wide range of potential applications, including plasma assisted combustion, plasma flow control, and electrically-excited discharge laser development. Despite this potential, fundamental understanding of these plasmas remains uncertain, particularly, time-resolved energy partition among vibrational and electronic states of nitrogen and oxygen during and after the discharge pulse.

In the present work, spontaneous Raman spectroscopy has been utilized in the study of vibrational energy loading and relaxation of nitrogen in mixtures containing pure nitrogen and air (P=100 torr) in a pin-to-pin, nanosecond pulsed electric discharge. A highly non-equilibrium vibrational distribution was observed for various gas mixtures and discharge pulse characteristics. Experimental data was analyzed with the assistance of a master equation kinetic model.