

SIMULTANEOUS KINETICS AND RING-DOWN (SKaR) IN A PULSED UNIFORM SUPERSONIC LAVAL FLOW- KINETICS OF THE REACTION $\text{CN}(\nu=1) + \text{O}_2$

S. Thawoos¹, G. Hall² and A. Suits^{1*}

¹*Department of Chemistry, University of Missouri, Columbia, MO, USA*

²*Chemistry Division, Brookhaven National Lab, Upton, NY, USA*

**suitsa@missouri.edu*

We report the development of a new apparatus that combines cw-cavity ringdown spectroscopy with a pulsed Laval flow (UF-CRDS). This is related to the CRESU (a French acronym for Reaction Kinetics in Uniform Supersonic Flows) technique, developed in France to study reaction kinetics at low temperatures. Cavity ringdown spectroscopy (CRDS) is a highly sensitive absorption technique relying on the decay of light between two high reflectivity mirrors of a cavity. For time-independent absorbing samples, the enhanced rate of power loss compared to the empty cavity leads to faster exponential decays. When the concentration of the absorbing species changes on the empty cavity ringdown time scale, non-exponential decays result, for which the instantaneous decay rate in excess of the empty cavity reference case provides a time-resolved measure of the sample absorbance. The long hydrodynamic time of the flow provides uniform temperature and pressure conditions well-matched to kinetic ringdown measurements in the time regime from 10 – 300 μs . This simultaneous kinetics and ringdown (SKaR) technique are coupled with a uniform flow for the first time. We will be reporting the design and operation of the newly developed UF-CRDS instrument and the rate constants measured for the reaction of $\text{CN}(\nu = 1)$ with O_2 at 70 K and 24 K obtained with this approach.

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