

SIMULTANEOUS KINETICS AND RING-DOWN (SKaR) IN A PULSED UNIFORM FLOW

SHAMEEMAH THAWOOS, NICOLAS SUAS-DAVID, *Department of Chemistry, University of Missouri, Columbia, MO, USA*; GREGORY HALL, *Division of Chemistry, Department of Energy and Photon Sciences, Brookhaven National Laboratory, Upton, NY, USA*; ARTHUR SUITS, *Department of Chemistry, University of Missouri, Columbia, MO, USA*.

We have developed a new apparatus that combines cw-cavity ringdown spectroscopy with a pulsed Laval flow (UF-CRDS)^a. This is related to the CRESU technique developed in France to study reaction kinetics at low temperatures^b. 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 time scale of the empty cavity ring-down time, 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 ring-down measurements in the time regime from 10-300 microseconds. This simultaneous kinetics and ring-down (SKaR) technique^c is here coupled with a uniform flow for the first time. We will be presenting rate constants measured for reactions of CN($v=1$) with O₂ at a range of temperatures from 70- 23 K obtained with this approach.

^aN. Suas-David, S. Thawoos, and A. G. Suits, *The Journal of Chemical Physics* 151 (2019) 244202

^bB. Rowe et al., *The Journal of Chemical Physics* 80 (1984) 4915.

^cS. S. Brown, A. Ravishankara, and H. Stark, *The Journal of Physical Chemistry A* 104 (2000) 7044.