MID-INFRARED CAVITY RING DOWN SPECTROMETER WITH A LEAD SALT DIODE LASER AND A QUANTUM CASCADE LASER

WAISHUN TAM, ZHENG SU, IGOR LEONOV, AND YUNJIE XU, *Department of Chemistry, University of Alberta, Edmonton, Alberta, Canada T6G 2G2a*.

We report the design, construction, and evaluation of a mid-infrared continuous wave cavity ring-down spectrometer. A pulsed molecular beam assembly with a home-made slit nozzle was constructed and incorporated into the spectrometer. A computer program was developed to automate and to synchronize the timing of the cavity ring-down experiments with the pulsed molecular beam. To initiate a cavity ring-down event, a frequency detuning scheme is exploited to effectively block the laser from entering the ring-down cavity by rapidly shifting the laser frequency. With a lead salt diode laser as laser source, the standard deviation of the experimental ring-down time, *i.e.* $\sigma(\tau)/ < \tau >$, was 0.63%, corresponding to a noise-equivalent absorption of 8.0×10^{-7} at a fixed laser frequency with an evacuated cavity with 10 averaging cycles. A room temperature infrared spectrum of methane and a jet cooled infrared spectrum of propylene oxide at 3.3 micron will be presented.

Very recently, we have set up a cw quantum cascade laser operating in the 5.7 micron region and will implement this into the cavity ring down spectrometer. The superior mode structure and output power of the quantum cascade laser promise a further improvement in the sensitivity of the spectrometer. Its performance will be compared with that of the lead salt diode laser based cavity ring down spectrometer.