MEASUREMENT OF TRACE ATMOSPHERIC CONSTITUENTS BY CW CAVITY RING-DOWN SPECTROSCOPY

A.J. ORR-EWING, M. PRADHAN, R. GRILLI, T.J.A. BUTLER, D. MELLON, M.S. AZIZ, and J. KIM,
School of Chemistry, University of Bristol, Bristol BS8 1TS, U.K..

Cavity ring-down spectroscopy (CRDS) with near-IR and visible diode lasers has been used to develop optical sensors for measurement of trace constituents of the troposphere, and to study the optical properties of aerosol particles. Results will be presented of atmospheric measurements of NO_2 and small volatile organic compounds (VOCs). The combination of pre-concentration techniques with cw CRDS allows detection limits for C_2H_2 to approach 10 pptv in ambient air.[a] Gas-chromatographic separation of the analyte of interest from other atmospheric VOCs is not necessary because of the selectivity that is achieved through the choice of adsorbent materials in the pre-concentration trap and the measurement via characteristic ro-vibrational lines in the near IR.[b]

An optical feedback CRDS instrument has been developed for rapid measurement of the extinction of light by aerosol particles. For single particles of diameter 1 μm, extinction cross sections can be measured from time-dependent cavity losses.[c] For smaller particles, statistical analysis of the variance in measured ring-down decay rates is used to extract extinction cross sections.

---

[a] M. Pradhan, R.E. Lindley, R. Grilli, I.R. White, D. Martin and A.J. Orr-Ewing, *Appl. Phys. B* 90, 1 (2008).
[b] A.M. Parkes, R.E. Lindley and A.J. Orr-Ewing, *Anal. Chem.* 76, 7329 (2004).
[c] T.J.A. Butler, J.L. Miller and A.J. Orr-Ewing, *J. Chem. Phys.* 126, 174302 (2007).