AerodyneResearch

Technology Enhancing Science

Laser Spectroscopic Measurement of CO_2 Isotopes *for Geochemistry*

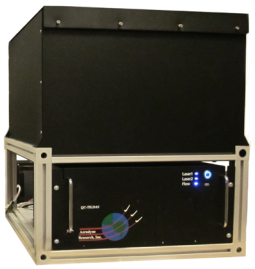
- ***High-precision, low-cost, fast*** **measurements compared to IRMS**
- **Isotopologue-specific, not mass-specific =>*no chemical processing or separation* of CO_2**
- **Suitable for samples derived from carbonate via acid digestion**

$\Delta^{17}O$ SPECTROMETERS

(clumped isotope spectrometer on reverse)

DUAL LASER INSTRUMENT

for $\Delta^{17}O$, $\delta^{18}O$, and $\delta^{13}C$



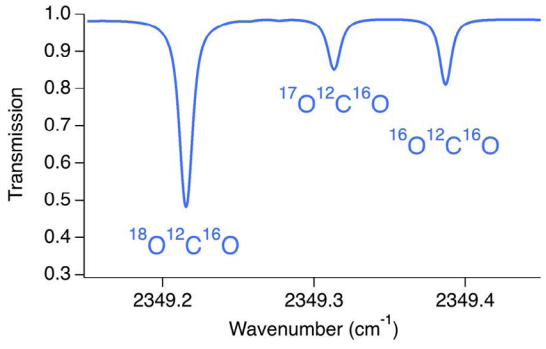
SINGLE LASER INSTRUMENT

for $\Delta^{17}O$ and $\delta^{18}O$

Precision for Discrete Samples

	CO_2	$\delta^{13}CO_2$	$\delta CO^{18}O$	$\delta CO^{17}O$	$\Delta^{17}O$	CO_2	$\delta CO^{18}O$	$\delta CO^{17}O$	$\Delta^{17}O$
1 Sample 0.25 µmol CO_2, 3 min	0.02 ppm	0.03 ‰	0.03 ‰	0.04 ‰	0.04 ‰	0.03 ppm	0.03 ‰	0.03 ‰	0.03 ‰
10 Samples 2.5 µmol CO_2, 30 min	**0.01 ppm**	**0.01 ‰**	0.01 ‰	0.013 ‰	**0.013 ‰**	**0.01 ppm**	0.01 ‰	0.01 ‰	**0.01 ‰**

Note: These measurements alternate the sample gas with a working reference of similar mixing ratio, and the time to do so is included in the quoted measurement time.



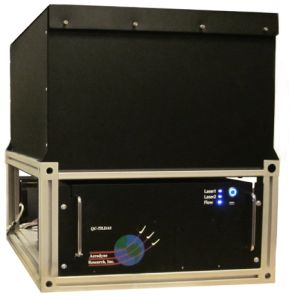
- Direct measurement of ^{17}O-CO_2, which is not possible by IRMS
- Automated inlet scheduling for samples, backgrounds, and calibrations
- Small sample size
- CO_2 must be mixed with a buffer gas

Laser Spectroscopic Measurement of CO_2 Isotopes *for Geochemistry*

- ***High-precision, low-cost, fast*** **measurements compared to IRMS**
- **Isotopologue-specific, not mass-specific =>*no chemical processing or separation* of CO_2**
- **Suitable for samples derived from carbonate via acid digestion**

CLUMPED ISOTOPE SPECTROMETER

($\Delta^{17}O$ spectrometers on reverse)



DUAL LASER INSTRUMENT for $\Delta^{13}C^{18}O^{16}O$

Precision for Discrete Samples

	CO_2	$\Delta^{13}C^{18}O^{16}O$
1 Sample <5 µmol CO_2 (0.5 mg calcite), 4 min	0.02 ppm	0.035 ‰
10 Samples <50 µmol CO_2 (5 mg calcite), 40 min	**0.01 ppm**	**0.01 ‰**

Note: These measurements alternate the sample gas with a working reference of similar mixing ratio, and the time to do so is included in the quoted measurement time.

Applications

- Paleothermometry
- Geologic Altimetry
- Burial, Diagenesis, and Metamorphism

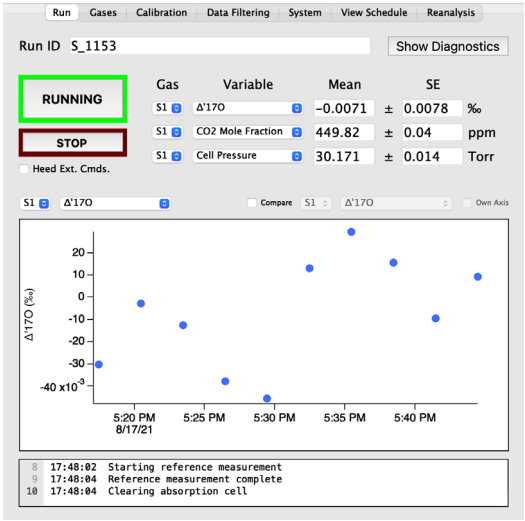
- Direct measurement of $^{16}O^{13}C^{18}O$ ($^{638}\Delta$) rather than mass 47 ($^{47}\Delta$)
- Automated inlet scheduling for samples, backgrounds, and calibrations
- CO_2 must be mixed with a buffer gas

TILDAS TECHNOLOGY

Aerodyne instruments use **tunable infrared laser direct absorption spectroscopy (TILDAS)** at mid-IR wavelengths to probe molecules at their strongest "fingerprint" transition frequencies. We further enhance sensitivity by employing a patented multi-pass broad-band absorption cell that provides optical path lengths up to 400 meters. Direct absorption spectroscopy allows for fast (<1 sec) absolute trace gas concentrations without need for elaborate calibration procedures. Moreover, TILDAS instruments are relatively free of measurement interference from other molecular species, enabling extremely specific detection.

IRIS INTERFACE

The IRIS interface provides easy, flexible instrument control and real-time results for $\Delta^{17}O$ spectrometers and clumped isotope spectrometers



Aerodyne specializes in collaboration and custom design. Please contact us if you would like to discuss additional measurement options and applications.

Aerodyne Research

45 Manning Road
Billerica, MA 01821
(978) 663–9500
www.aerodyne.com

CONTACT US

CO2 Isotopes for Geochemistry