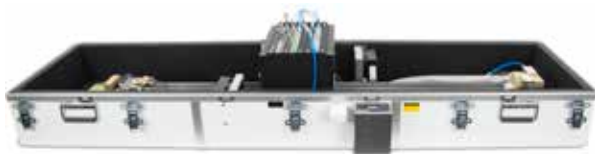




# TGA200A高频痕量气体分析仪

CSI公司从1993 年开始生产TGA 系列痕量气体分析仪，痕量，是物质中含量在百万分之一以下的组分，TGA使用可调谐半导体激光吸收光谱技术 ( tunable diode laser absorption spectrometer, TDLAS), 目前新一代的激光器使用电子恒温技术，新技术高精度、耐用、便携，可在实验室或者野外直接使用，由于测量光路体积小，响应快，所以适合多种应用。TGA200A 有一个坚固保温的外壳，可在全天候条件下直接使用。它可以用来测量氧化亚氮、甲烷、二氧化碳及其同位素的浓度，由于有超高的测量频率，所以能进行严格的涡动相关通量计算。



选配:

电子恒温激光器

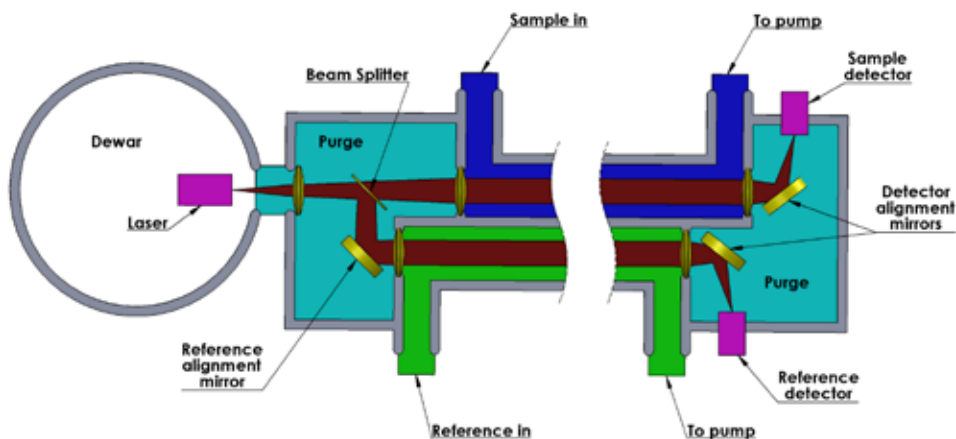
5种可选激光器 ( 每台TGA200A只能选择其中一种 )

其中3种激光器可同时测量多种气体

所有激光器均使用电子恒温技术，不需要液氮制冷  
安装调试好以后，分析仪本身不需要维护

TABLE A-2. TE-cooled Lasers		
Part Number ( pn )	Target Gas(es)	Molecular Formula
30477	Methane	CH <sub>4</sub>
30478	Nitrous Oxide	N <sub>2</sub> O
31121	Nitrous Oxide and Carbon Dioxide	N <sub>2</sub> O and <sup>13</sup> C <sup>16</sup> O <sup>16</sup> O
31119	Carbon Dioxide and δ <sup>13</sup> C	<sup>12</sup> C <sup>16</sup> O <sup>16</sup> O and <sup>13</sup> C <sup>16</sup> O <sup>16</sup> O
30877	Carbon Dioxide ( δ <sup>13</sup> C and δ <sup>18</sup> C )	<sup>12</sup> C <sup>16</sup> O <sup>16</sup> O, <sup>13</sup> C <sup>16</sup> O <sup>16</sup> O and <sup>12</sup> C <sup>18</sup> O <sup>16</sup> O

## TGA200A高频痕量气体分析仪内部构造图 以及光路结构图



### TGA200A光路结构

新一代的TGA200A 参比室与采样室光路长度相同，最大限度地提高了对比测量的分辨率；在测量特殊气体时，可选择使用高纯氮气作为吹扫气，最大限度地降低了环境气体浓度对测量的影响；使用电子恒温技术，最大限度地降低了系统的维护量，同时降低了分析仪的重量。

### 分析仪内部构造图





# TGA200A高频痕量气体分析仪

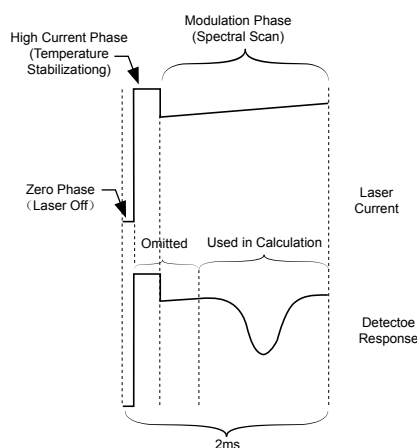
## 应用领域

- ◆ 能量平衡及涡动相关系统
- ◆ 碳氧同位素通量
- ◆ 甲烷CH<sub>4</sub>通量
- ◆ 氧化亚氮N<sub>2</sub>O通量
- ◆ 各种气体的单点廓线测量 (类似AP200 系统)
- ◆ 各种气体的气室测量 (类似土壤呼吸系统)

## 测量时续

TGA 内部使用CSI 公司最高级的CR9000 进行激光器的测量控制, 将2ms 的测量流程分成100 个时间单位进行精确的控制和测量, 每次测量耗时20 微秒。单个测量流程分为0 电流阶段、高电流阶段和调节电流阶段, 在三个阶段使用不同的电流来激发激光器, 同时记录两个接收器接收到的信号, 进行对比计算得出参比室和采样室气体的吸收比, 配合标准气体浓度计算出采样气体的浓度。(参看右图)

TGA200A 偏移		
化学式	偏移	单位
N <sub>2</sub> O	1.5	nmol mol <sup>-1</sup>
CH <sub>4</sub>	7.0	nmol mol <sup>-1</sup>
N <sub>2</sub> O	1.8	nmol mol <sup>-1</sup>
CO <sub>2</sub>	0.3	μmol mol <sup>-1</sup>
CO <sub>2</sub>	0.15	μmol mol <sup>-1</sup>
δ <sup>13</sup> C	0.5	‰
CO <sub>2</sub>	0.5	μmol mol <sup>-1</sup>
δ <sup>13</sup> C	2.0	‰
δ <sup>18</sup> O	2.0	‰



## 技术参数

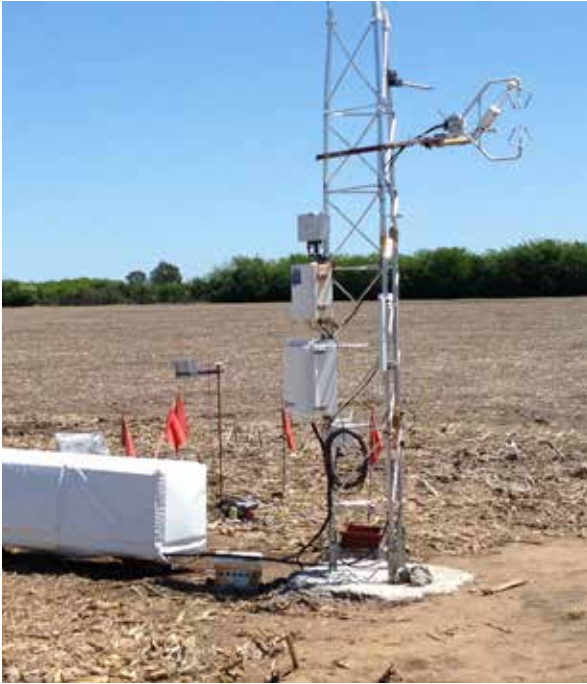
- ◆ 测量频率 (500Hz 单种气体, 250Hz 两种气体, 167Hz 三种气体)
- ◆ 采样室延迟时间 (TGA200A 的采样室体积只有0.200L, 当使用RB0021 采样泵时, 延时为40ms)
- ◆ 电源 (必须有交流电):
- ◆ 分析仪 (电子恒温型激光器): 90 to 264 Vac, 47 to 63Hz, 34W (max) 22 W(typical)
- ◆ 加热器: 90 to 264 Vac, 47 to 63 Hz, 150 W (max) 50 W (typical)

## 泵

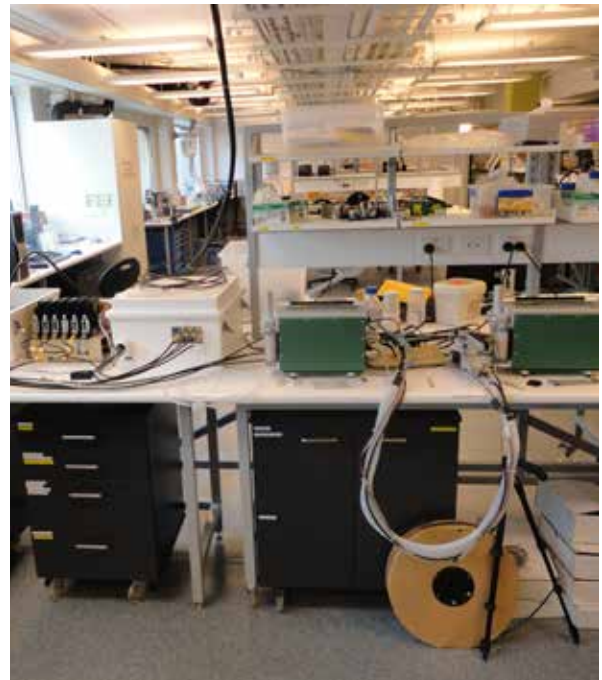
- ◆ RB0021-L Sample Pump, 18 slpm at 50 mb 高速采样泵, 用于通量测量
- ◆ XDD1 Sample Pump, 1 slpm at 50 mb 低速采样泵, 用于廓线、气室采样等
- ◆ DOAV502 Vacuum Pump 50 L min<sup>-1</sup> at 180 mb 旁通泵, 辅助廓线测量, 一般8 个以下通道使用
- ◆ DAAV505-L Sample Pump 100 L min<sup>-1</sup> at 180 mb 旁通泵, 辅助廓线测量, 一般8个以上通道使用
- ◆ 长度:211 厘米
- ◆ 宽度:47 厘米
- ◆ 高度:55 厘米
- ◆ 重量:78.6 g

## 分析仪优点

- ◆ 电子恒温技术, 不需要加注液氮制冷(以前的所有需要加注液氮的TGA 均可升级)
- ◆ 5种温室气体、稳定同位素组合测量:
- ◆ CH<sub>4</sub>、N<sub>2</sub>O、N<sub>2</sub>O、和CO<sub>2</sub>、及 δ<sup>13</sup>C、CO<sub>2</sub>及 δ<sup>13</sup>C和 δ<sup>18</sup>O
- ◆ 高精度, 1.5nmol/mol (ppb, 不同气体略有差别) 的数据稳定性
- ◆ 高速度, 500Hz 的测量频率, 十分适合做各种痕量气体的通量研究
- ◆ 响应快, 测量光路体积小, 所以浓度时滞小, 适合多种应用
- ◆ 耐用, 良好、坚固的设计, 确保产品可多年连续使用
- ◆ 方便运输, 坚固自成体系的运输箱可直接运输
- ◆ 超长的光路维护量小, 单光路设计不需要定期进行光路清洁
- ◆ 适应范围广, 可在实验室或者野外直接使用, 不需要额外的空调房



应用案例一：阿根廷东北部用于玉米、大豆耕地的碳、氮、水交换研究（ $N_2O$ ， $CO_2$ ， $H_2O$ 涡动相关）使用TAG200A、CSAT3及其他常规传感器



应用案例二：澳大利亚大学植物物候实验室进行植物基因拼接实验，通过对 $C^{13}$ 和 $C^{14}$ 同位素的测定来检验植物杂交的结果使用了TGA200等仪器



应用案例三：美国明尼苏达，用来测量 $\text{CH}_4$ 和 $\text{CO}_2$ 通量使用TGA100A、CSAT3及其他传感器



应用案例四：巴西，农田不同作物 $\text{N}_2\text{O}$ 通量测量，TGA200安装在集装箱里，周围有4个采样点，每点上下两层进气口来计算 $\text{N}_2\text{O}$ 通量，同时使用CSAT3和热线热电偶测量感热通量



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