Volcanic Gas Emission Measurements Using Tunable Mid-IR DFG Based Sensors

Dirk Richter, Dirk Rehle, and Frank K. Tittel
Laser Science Group, Rice University, USA
http://www.rice.edu/~lasersci

Clive Oppenheimer, Hayley J. Duffell, Rodney L. Jones
Volcano Remote Sensing Group, University of Cambridge, UK
http://www.geog.cam.ac.uk/intro/activ/volcano/volcano.htm

Mike Burton
Sistema Poseidon, 95030 Nicolosi, Catania, Italy
Crater diameter: 500 m

Last Strombolian Explosion: 1997

Current degas rate:
- HCl $\sim 20$ kT/hour
- $SO_2 \sim 60$ kT/hour

For comparison:
Total $SO_2$ release in UK:
$\sim 0.2$ kT/hour in 1998
**FTIR**

- Resolution: 0.5 cm\(^{-1}\)
- Tuning range: 500 - 6000 cm\(^{-1}\)
  
  (1.7 - 20 \(\mu m\))

**DFG Based Gas Sensor**

- Resolution: 0.0013 cm\(^{-1}\)
- Tuning range: 2270 - 3000 cm\(^{-1}\)
  
  (3.3 - 4.4 \(\mu m\))
Schematic of DFG Based Gas Sensor

Dimensions: 24" x 21" x 8"
Including:
- laser drivers
- stepper motor controller

Detection of HCl at 3.3 μm
Detection of $\text{SO}_2$ at 4.2 $\mu$m
Summary

- Fiber based DFG gas sensors
- Single and multi-species detection
- Highly sensitive and selective
- Robust field portable technology

Mature technology, ready for use in:

Laboratory, field, industrial and airborne applications