Laser-Based Sensor For Detection Of Hazardous Gases In The Air Using Waveguide CO2 Laser

Gondal, MA; Bakhtiari, IA; Dastageer, AK

TAYLOR FRANCIS INC, JOURNAL OF ENVIRONMENTAL SCIENCE AND HEALTH PART A-TOXIC/HAZARDOUS SUBSTANCES ENVIRONMENTAL ENGINEERING; pp: 871-878; Vol: 42

King Fahd University of Petroleum & Minerals
http://www.kfupm.edu.sa

Summary

A spectrometer based on the principle of photoacoustic spectroscopy has been developed recently at our laboratory for the detection of hazardous gases such as O-3, C2H4, SO2, NO2 and SF6. In most of our earlier works, we employed a mechanical chopper to modulate the laser beam and this chopper modulation has the crucial disadvantage of instability in the chopper frequency. Even a minor shift of about 1 Hz in the modulation frequency could significantly reduce the photoacoustic signal by an order of magnitude at the acoustic resonant mode of the photoacoustic cell. To overcome this problem, we developed a photoacoustic spectrometer where a wave guided CW CO2 laser beam is modulated electronically with the external frequency generator. Our preliminary results show that the electronic modulation of CO2 laser beam improved the sensitivity of our spectrometer by a factor of 6. The parametric dependence of photoacoustic signal on laser power, modulation frequency and trace gas concentration, was investigated and the comparison between the two modulation techniques is presented in this paper for detection of trace gases such as C2H4.

References:
1. CALLASSO IG, 1999, REV SCI INSTRUM, V70, P4569
2. CVIJIN PV, 1988, APPL SPECTROSC, V42, P770
3. DANKE H, 2000, APPL PHYS B, V70, P275

© Copyright: King Fahd University of Petroleum & Minerals; http://www.kfupm.edu.sa
5. DEVRIES HSM, 1996, POSTHARVEST BIOL TEC, V8, P1
7. GERLACH R, 1980, APPL PHYS, V23, P319
8. GONDAL MA, 1997, APPL OPTICS, V36, P3195
10. GONDAL MA, 2001, APPL OPTICS, V40, P2010
11. GONDAL MA, 2002, IEEE T DIELECT EL IN, V9, P421
12. HARREN FJM, 1990, APPL SPECTROSC, V44, P1360
13. HESS P, 1983, RESONANT PHOTOACOUST, V111, P1
14. HORENBERGER C, 1995, CHEM PHYS LETT, V190, P171
15. MENZEL L, 2001, APPL PHYS B-LASERS O, V72, P859
16. MEYER PL, 1990, REV SCI INSTRUM, V61, P1779
17. MIHALCEA RM, 1998, MEAS SCI TECHNOL, V9, P327
19. PAO YH, 1997, OPTOACOUST SPECTRO
20. SCHAFFER S, 1997, APPL OPTICS, V36, P3202

For pre-prints please write to: magondal@kfupm.edu.sa