ABSTRACT FOR PLENARY LECTURE AT EUROPTRODE (1) GRAZ, AUSTRIA (13-16 APRIL 1992) 578

GAS SENSORS USING CORRELATION SPECTROSCOPY, COMPATIBLE WITH FIBRE-OPTIC OPERATION

J.P. Dakin, H.O. Edwards

Optoelectronics Research Centre
University of Southampton
Southampton SO9 5NH, U.K.

Abstract

The paper reports three basic methods of gas sensing using real-time correlation spectroscopy. In each method, a sample of the gas to be measured is used as a matched optical filter in order to recognise similar features in the absorption spectrum of gas in the measurement cell.

Our results on methane detection using pressure modulation spectroscopy will be shown, where a gas-filled resonant acoustic cavity is used as a reference cell. Measurements with a noise-limited sensitivity of only 50 ppm have been made. For this approach we shall also show how the method offers excellent selectivity, showing a greatly-reduced response to possible contaminants having dissimilar, yet overlapping, absorption spectra.

We shall also report on measurements of ammonia, using an electrically excited Stark Modulation cell with no moving parts. A noise-limited sensitivity of 160 ppm was achieved. This method is, of course, only applicable for the measurement of gases having a strong dipole moment.

Our final method totally avoids the need to apply modulation to either measurement or reference cell, and involves insertion of an electro-optic frequency shifter between the cells. This approach has previously only been applied to the measurement of low-pressure gases in the upper atmosphere of planets, where very little pressure broadening occurs and only modest demands are made on the modulator technology. Our work demonstrates the first reported measurements of gas at full atmospheric pressure using this method, in addition to the first fibre-optic-remoted operation.

All the above methods are the subject of an on-going R & D programme and performance is still being improved. In addition, for each method a laboratory demonstrator is under construction.