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Miniaturization of Infrared-Gassensors

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Infrared gasanalyzers, especially NDIR[1]-Type instruments, have been used in many applications for environmental monitoring and process control since 1943 [1]. The advantage of the NDIR-Technique is a very selective output signal with no cross interference to other gases in the gas mixture. Compared to other gasanalysis principles the stability (zero and span) can´t satisfy the requirements of special applications. Furthermore the optical design (double beam sample cell, Luft-type detector etc.) and the calibration technique (gas cylinder or calibration cell) [2] of these analyzers are still very complex and expensive.
In this contribution a novel approach of infrared gas sensing will be described. Infrared gas sensor of the new generation use solid state detector (e.g. Pyroelectric) and interference filters. The long term stability of a single beam/wavelength sensor (SWS) is poor and the performance for a double beam/wavelength (DWS) is much better. For extremely low cost applications (e.g. indoor climate control) a new technique is proposed. The disadvantage of a single beam sensor is the zero and span drift in case of the radiation loss of the light source. The typical drift behaviour of a thermal radiator is in the range of 10-30% p.a. This radiation drift leads to a sensor drift in the same order of magnitude. For a photoacoustic sensor (PAS) the radiation drift leads only to a span drift. In this paper a combination of both, SWS and PAS, is described. This new sensor consists of a PAS-cell with an additional pyroelectrical detector in order to monitor the infrared radiation of the light source in the identical spectral region of the gas absorption band [3]. The calculation (difference and ratio) of the output signal uses both detector signals to achieve an extremely stable output voltage. The gas exchange is achieved by a thin polymer membrane or alternatively by a micropump. The overall size of the sensor (see below) is very small (20x20x35mm).

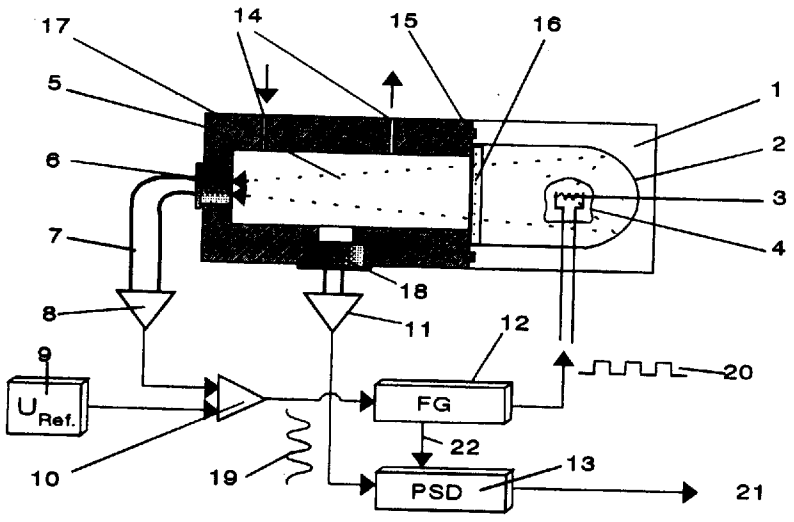

Figure: Design of the new infra red gas sensor for indoor monitoring purpose

[1] Luft K.F., Schaefer W., Wiegleb G.: 50 years NDIR-gas analysis. tm-Technisches Messen 60 (1993) 363-371
[2] Wiegleb,G.: A new calibration technique for industrial gas analyzers. Process Control and Quality, 3 (1992) 273-281
[3] Wiegleb,G.: Gasanalyzer. German Patent Appl. No. 195 25 703.0 (1995)

[1] Non Dispersive Infra Red