Oil Contamination Sensor System

Mihaela Albu and Michal Radziwon

General introduction

An important requirement in many industries is clean compressed air. In particular in critical production processes of the chemical and pharmaceutical industry, in food production and surface coating, the analysis and control of compressed air quality is a crucial factor. The aim of the project is to develop an online sensor system for the detection of the oil vapour contamination in compressed air according to ISO 8573 using the principle of photo-acoustics.

Research results

The investigations have been focused on the photo-acoustic detection of gaseous n-heptane in synthetic air (SA, 5.5) at room temperature and atmospheric pressure. The experiments were performed using the experimental setup which schematic diagram is presented in Figure 1. A distributed-feedback (DFB) infrared laser diode (1725 nm) has been used as light source. A modulated irradiation of the gaseous sample in the photo-acoustic (PA) Cell causes periodic pressure variations (i.e. sound) that can be detected by a microphone and measured using a lock-in technique.

Figure 1: Schematic diagram of the experimental setup.
The photo-acoustic resonator operates in its first longitudinal mode. The PA spectrum of n-heptane in synthetic air (for various concentrations: 3 ppbV - 25 ppmV) at atmospheric conditions was recorded by scanning the stimulus laser modulation frequency between 1500 and 1800 Hz. The maximum signal (weighted average over 24 points) was calculated and plotted versus different concentrations of n-heptane in synthetic air (Figure 2). Figure 2 shows a good linearity of the PA sensor across the investigated concentration range.

![Figure 2: Extracted photo-acoustic signal plotted against the concentration of n-heptane.](image)

**Upcoming research 2011**

The investigations will continue with the detection of n-heptane in nitrogen and then with the detection of different types of oil in compressed air.

**Papers**