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Breath analysis with optical methods

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Fast progress of optoelectronics technologies opens new opportunities in trace matter detection in gases. That induces development of efficient methods of in situ investigation of breath and the detection of specific disease markers. Due to miniaturization of the optical apparatus the desktop systems are constructed. Near infrared (NIR) and middle infrared (MIR) spectral ranges are the most suitable for this investigation but some of the markers might be also detected by UV radiation. During our lecture the high sensitivity techniques of trace matter detection by light absorption in gases will be presented. Multipass, optoacoustics and cavity ring down spectroscopy (CRDS) as well as the modulation spectroscopy are the most useful for these applications. Contemporary lasers and wavelength meters provide opportunity of very precise line selection and tuning to characteristic absorption lines of selected compound. That makes possible to distinguish specific markers existing in the breath at low mixing ratio (ppm or ppb) among dense interfering species like water vapor and carbon dioxide (5 % each). In our laboratories the development of optoelectronic detection systems of disease markers are performed within SENSORMED project. Within UV – MIR spectral range the registration of the biomarkers like acetone (266 nm), ammonia (1527,0005 nm), methane (2253,6500 nm) and carbon monoxide (2333,7197 nm) as well as nitric oxide (5263 nm), ethane (3330 nm) and carbonyl sulfide (4875 and 5007 nm) is possible. Theoretical calculations show that the detection with a sensitivity exceeding many times the level of healthy breath is possible. In our presentation we will show experimental results of these markers detection.

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