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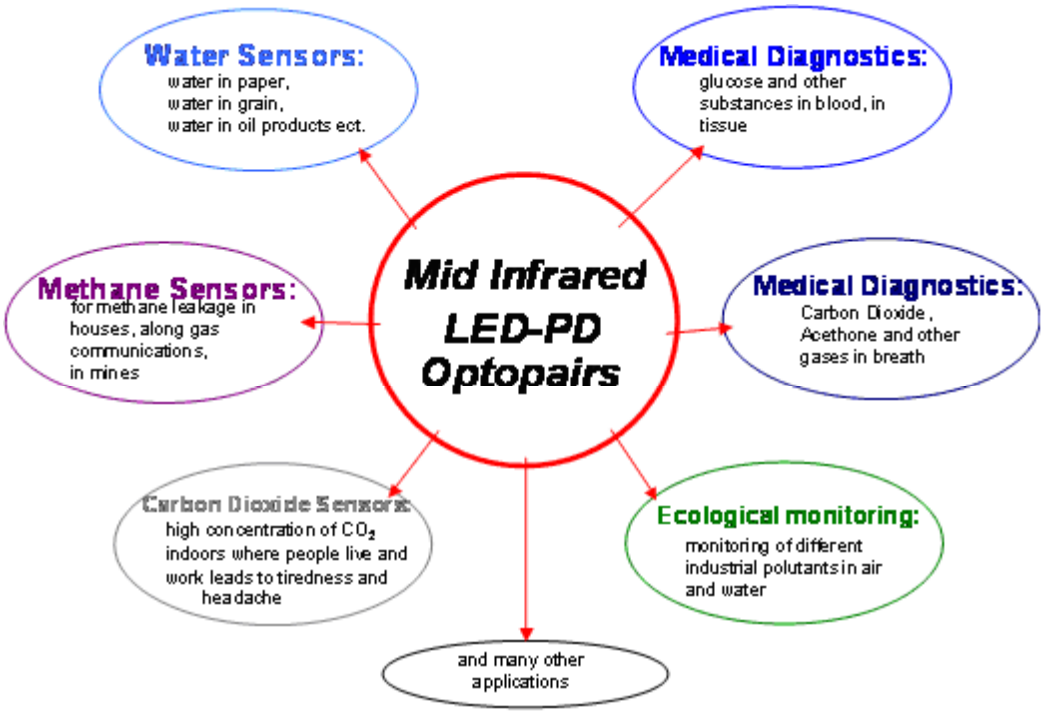
Applications

We propose our optoelectronic devices for mid-infrared spectral range as a new powerful base for optical absorption analysis. One of the great advantages of this method is that virtually any sample in virtually any state may be studied. Liquids, solutions, pastes, powders, films, fibers, gases and surfaces can all be examined with a proper choice of sampling technique. This approach may be used for the analysis of one component in a mixture, especially when the compounds in the mixture are alike chemically or have very similar physical properties.

Most of commercially available instruments for this analysis employ quite sophisticated large-sized and expensive spectrometers that provide measurements solely at the laboratory. Using IBSG LED-Photodiode optopairs for mid-infrared spectral range allow developing portable sensors with high reliability and adequate accuracy that can be successfully applied in different areas for matter analysis purposes.



Examples of portable sensors (test models) based on LED-PD optopairs developed at IBSG

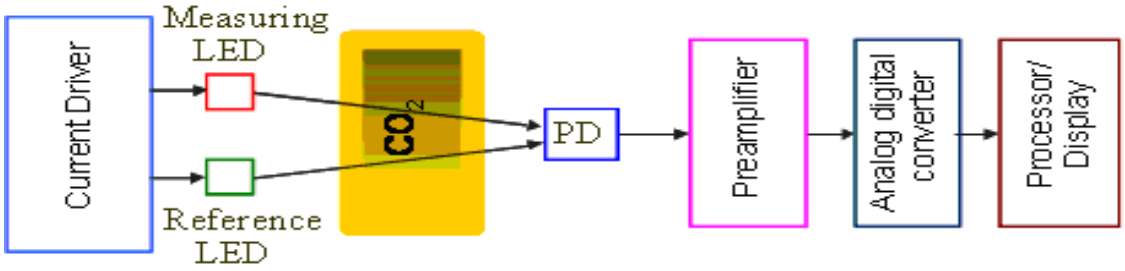
Carbon Dioxide Sensor

Water in Cut-Oil Sensor

Principle of Infrared Optical Absorption Analysis

Infrared optical analysis is based on the vibrations of the atoms of a molecule. Infrared radiation passes through a sample and the fraction of the incident radiation that is absorbed at a particular energy is determined. The energy at which any change in the absorption occurs corresponds to the frequency of a vibration of a molecule that is analyzed.

Principle scheme for chemical agents sensing based on LED-PD optopair is quite simple. Measuring LED emits radiation at wavelength corresponding to maximum absorption of the analyte. Reference LED emits at wavelength that corresponds to the absence of absorption of the analyte. Signal difference between measuring LED that is partially absorbed in optical cell and the reference LED is proportional to the concentration of the analyte.



There are strong absorption bands of many chemical agents at mid-infrared spectral range that allow their detection with sensor devices based on LED-PD optopairs. Some of these chemical agents and their absorption bands are presented here:

CH_4 1.65; 2.30 μm; 3.2÷3.45 μm	CO_2 2.00; 2.65 μm; 4.2÷4.3 μm	H_2O 2.65÷2.85 μm; 1.86÷1.94 μm	N_2 4.0÷4.54 μm
C_2H_2 2.99÷3.09 μm	HOCl 2.6÷2.9 μm	HCl 3.33÷3.7 μm	NH_3 2.27; 2.94 μm
C_2H_4 3.1÷3.4 μm	HBr 3.7÷4.0 μm	OH 2.38÷2.63 μm	NO+ 4.08÷4.44 μm
C_2H_6 3.3; μm;	HI 2.27÷2.3 μm	H_2CO 3.38÷3.7 μm	HNO_3 5.74÷5.98 μm
CH_3Cl 3.22÷3.38 μm	H_2S 3.7÷4.4 μm 2.5÷2.8 μm	CO 2.24 μm; 4.4÷4.8 μm	NO_2 3.4 μm
OCS 3.45; 4.87 μm;	HCN 2.94÷3.1 μm	HO_2 2.73÷3.1 μm	SO_2 4.0 μm
C_6H_6 2.44÷2.47 μm 3.17÷3.33 μm	$CHBr_3$ 2.39 μm; 3.29 μm	$C_2H_4Cl_2$ 3.23÷3.51 μm	$C_2H_2Cl_2$ 2.50÷2.86 μm
C_2HCl_3 3.22÷3.25 μm; 4.20÷4.35 μm	H_2O_2 3.70÷3.85 μm; 4.17÷4.35 μm	HF 2.33÷2.78 μm; 4.17÷4.43 μm	C_3H_8 3.28÷3.57 μm