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# MIR-FIBER SENSORS FOR REMOTE SPECTROSCOPY AND PYROMETRY IN 4-16 um REGION

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Recent development in technology of polycrystalline silver halide fibers for Medium Infrared Region 4-16um (MIR-fibers - Fig.1) opens a new area of applications of IR-spectroscopy in "fingeprint region" of molecular vibrations for the most of gaseous, liquid and solid substances. Fiber accessories for FTIR- (Fig.2) and TDL (Tunable Diode Laser) spectrophotometers (Fig.3) include fiber coupler to FTIR-inerferometer or to TDL, pig-tail LN cooled HgCdTe-detector, MIR-fiber cables and a variety of evanescent probes and gas/liquids cells.

Promising applications are on line in real time chemical reaction control (Fig.4a), biomedical diagnostics in vivo (Fig.4b) and pollution monitoring (Fig.4c). Remote process control and environment monitoring with multichannel fiber probes are faciliated for petrochemical, polymer, pharmatheutical and food industry even for toxic and hazardous environments.

Synergy of MIR-fibers with sensitivity of LN cooled MCT--detectors creates the new opportunity of non-contact heat irradiation monitoring for 100-600K range (Fig.5-6). Flexible handling of MIR-fiber pyrometer and endoscopical IR-imaging with MIR-fiber bundle became possible.

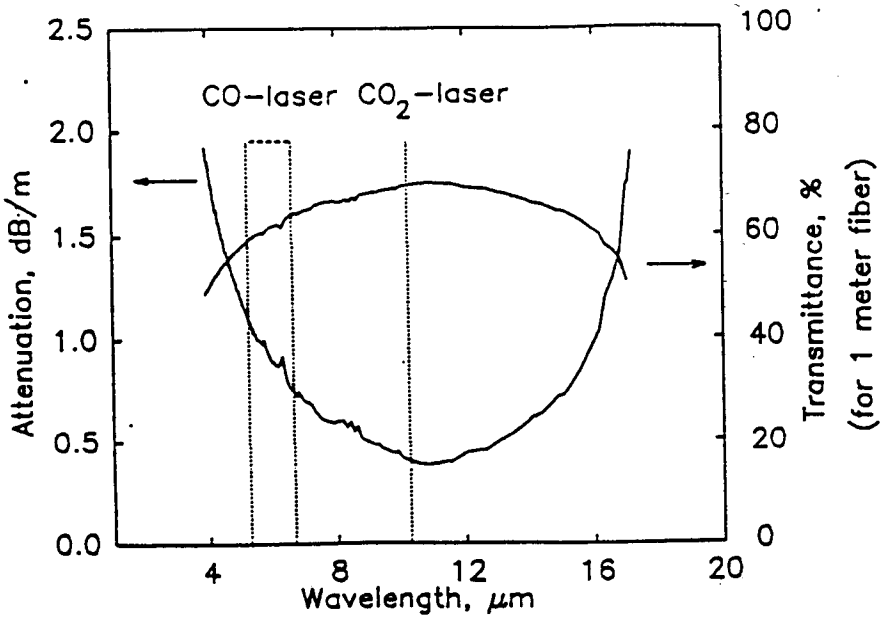



Fig.1 Spectra of transmittance and optical losses of MIR-fibers

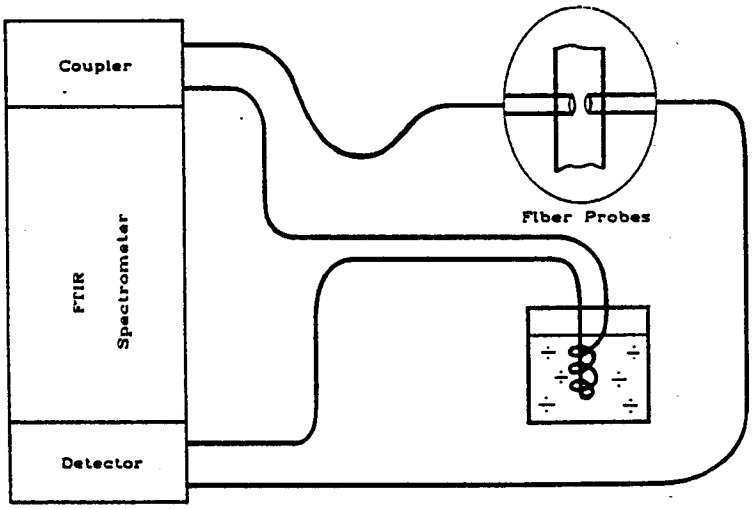



Fig.2 Scheme of MIR-fiber probes with FTIR-spectrophotometer

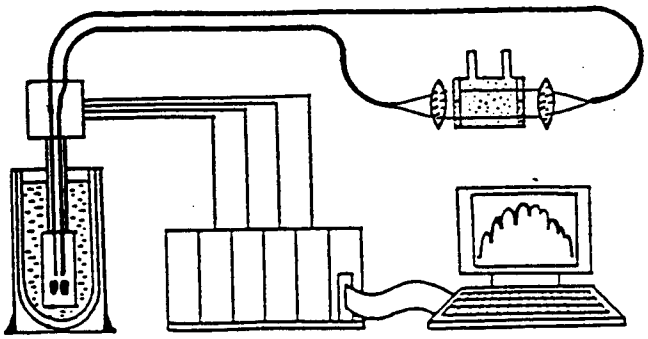
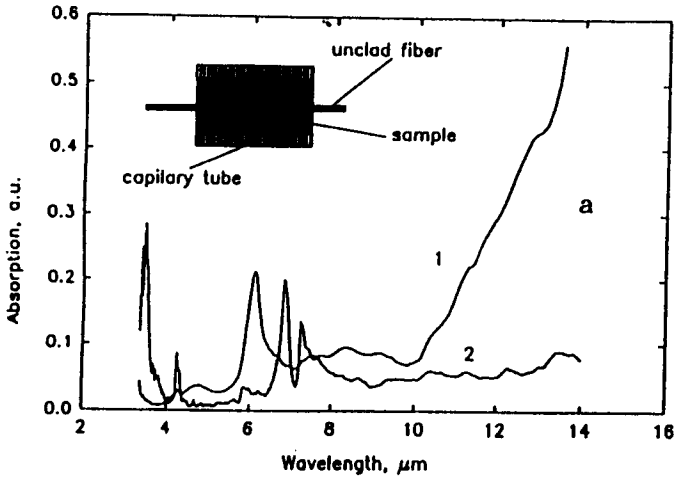
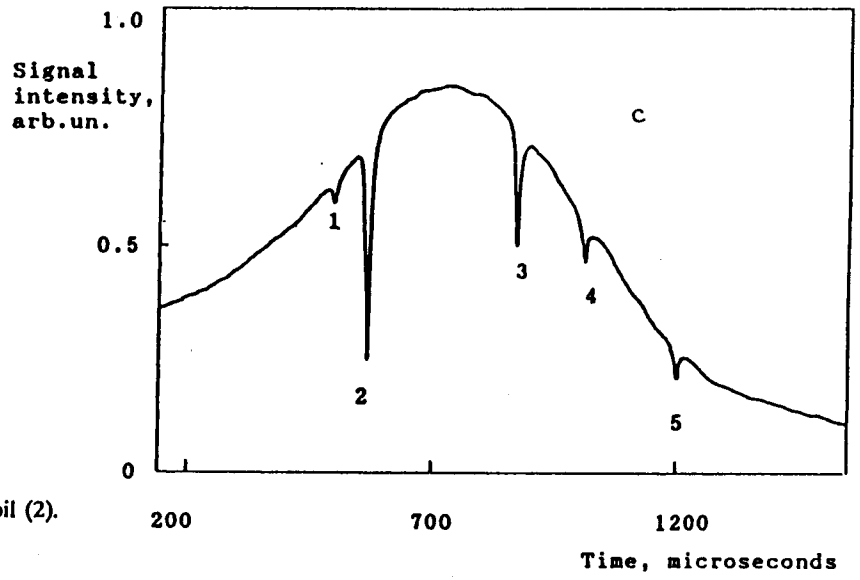


Fig.3 Scheme of TDL-spectrophotometer with MIR-fibers for gas analysis

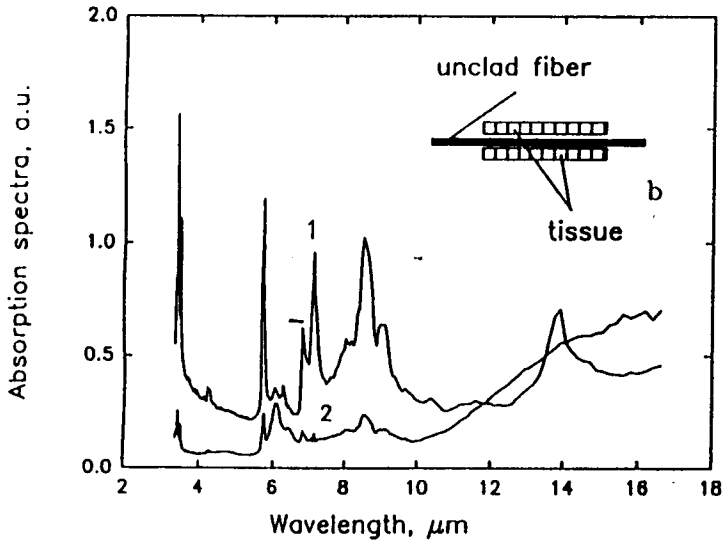



Evanescent spectra of aqueous solution of sulphuric acid (1) and technical oil (2).




Tunable diode laser pulse intensity with transmission spectrum of natural isotope mixture of ammonium near 990 $cm^{-1}$ region. An assignment of the absorption lines:

1. aR(2,2) of $\nu_2$ $^{15}NH_3$ -987.632 $cm^{-1}$ (13),
2. R(1.0) of $a2n_2-s\nu_2$ $^{14}NH_3$ -987.741 $cm^{-1}$ (14),
3. R(1.1) of $a2n_2-s\nu_2$ $^{14}NH_3$ -988.200 $cm^{-1}$ (14),
4. aR(2,2) of $\nu_2$ $^{15}NH_3$ -988.397 $cm^{-1}$ (13),
5. aR(2,2) of $\nu_2$ $^{15}NH_3$ -988.648 $cm^{-1}$ (13).




Evanescent spectra of adipose (1) and blood-forming (2) tissue.

Fig.4 Examples of spectra, obtained with MIR-fiber evanescent probes (a,b) and FTIR-spectrophotometer, and TDL-spectra of $NH_3$ with fiber multipass cell (c)

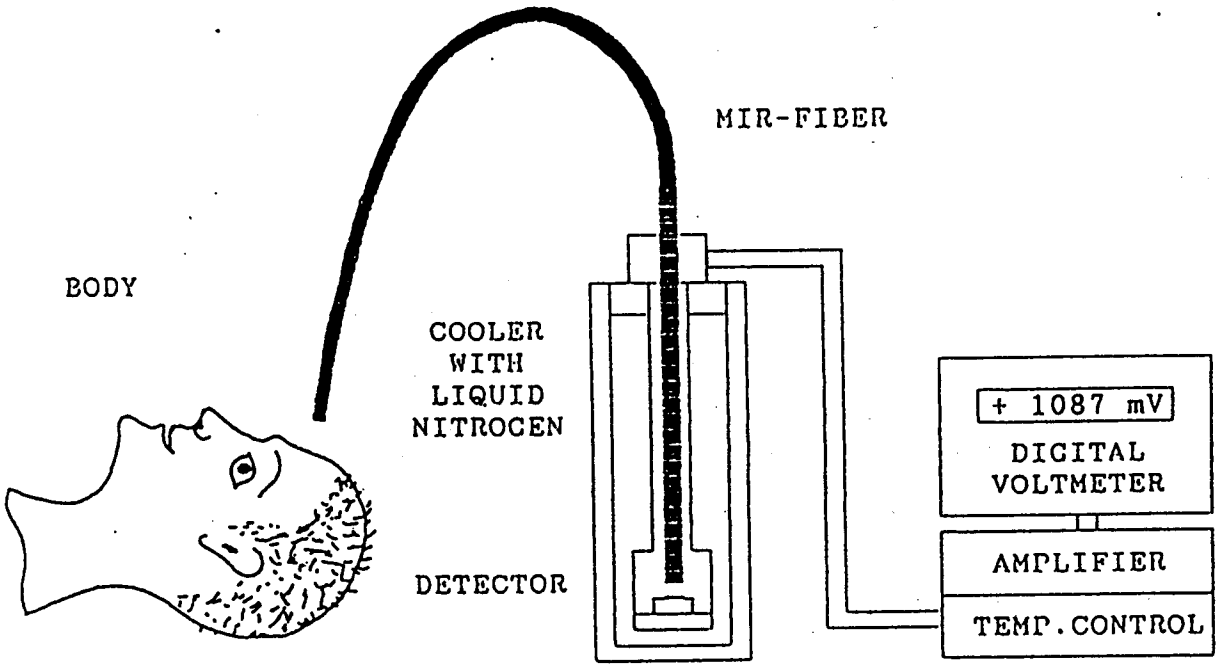



Fig.3. The general scheem of the MIR-fiber sensor.

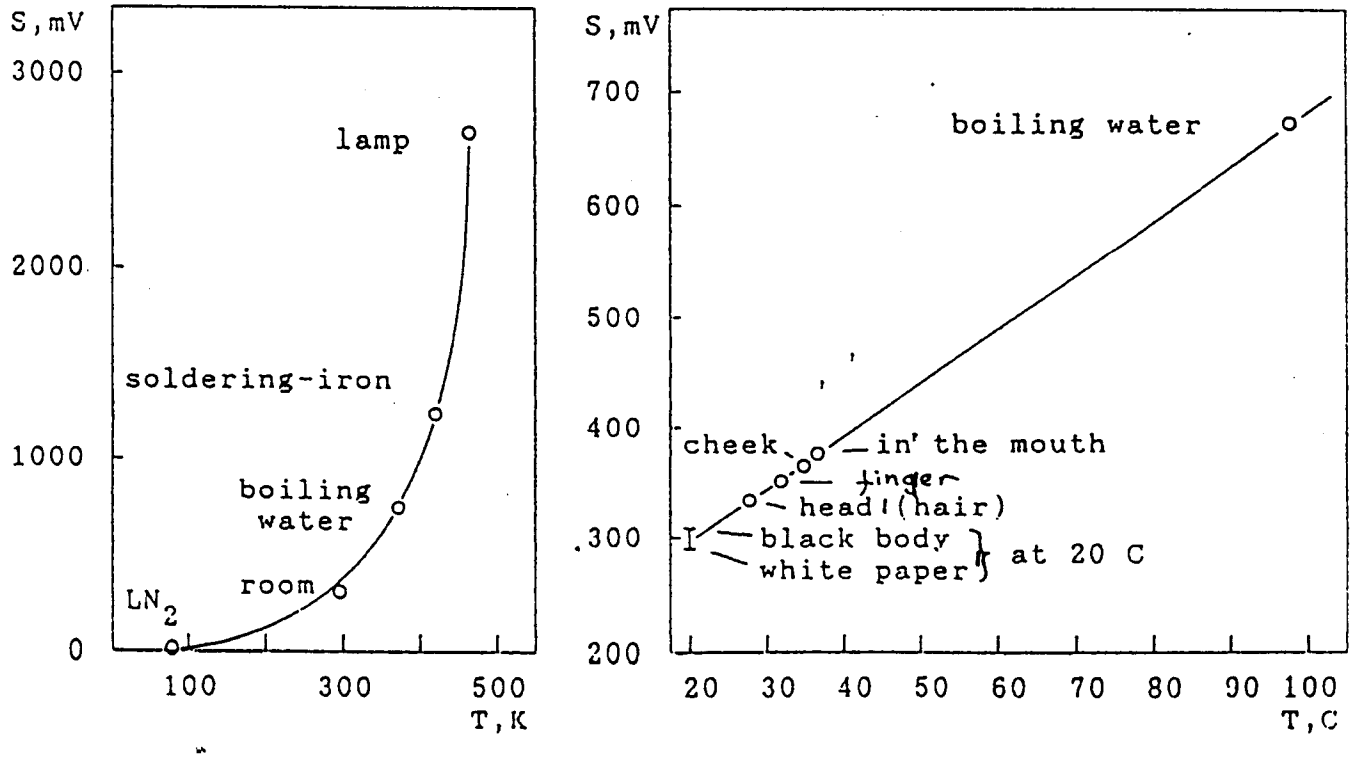



Fig.4. Calibration of MIR-sensor, a) and the resuls on measuring radiation coming from human body, b).