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Experimental study of the effect of ambient air absorption and heat diffusion in light absorption measurements in transparent dielectircs using Time-resolved Photothermal Common-path Interferometry

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Measurements of ultra-low (≤10^{-6} cm^{-1}) absorption in synthetic crystalline quartz were demonstrated using a modified time-resolved photothermal common-path interferometry scheme under conditions of influence of ambient air absorption and heat diffusion in a sample heated by laser radiation. The characteristic times of heat diffusion in ambient air and crystalline quartz were measured. The absorption coefficient was calculated by processing the waveforms of signals obtained in different crystal volumes using a theoretically determined thermooptical parameter. The modification of the optical part of the scheme has been carried out, aimed at creating a Gaussian-like shape of laser beams in the volume of measured samples in order to minimize calibration errors. Taking into account the influence of ambient air absorption on measurements, the minimum absorption of the crystal was estimated as ~7×10^{-8} cm^{-1}, which coincided with the theoretical estimate of the absorption lines of quartz located in the UV region of the spectrum.

Keywords: photothermal common-path interferometry, low absorption measurement, ultrapure materials, impurities, heat diffusion.

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