
Laser flash measurement of the phononic thermal diffusivity of glasses in the presence of ballistic radiative transfer

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Abstract. A new technique has been developed for measuring the phononic thermal diffusivity of glasses by the laser flash method at temperatures between 300 and 1000 K. The usual calculation procedures for laser flash devices are based on the Fourier differential equation, which takes into consideration only diffusion processes. In glasses, additional radiative heat transfer appears at high temperatures, causing a change in the characteristic form of the temperature – time curve. Therefore, the evaluation of the experimental data must be modified.

For the description of the temperature – time curve, a new theoretical model has been developed, which allows for ballistic radiative heat transfer between the sample surfaces. This model allows examination of the thermal diffusivity of glasses, even if radiative perturbations appear. It was applied to the experimental data obtained for two different glass samples, where the ballistic radiative transfer is nonnegligible. It was shown that the latter can be eliminated if the front side is gold-coated. The results obtained for the gold-coated glass specimens are compared with results on uncoated samples evaluated with both the new model and the normal theory. The deviations at 1000 K are in the region of 15%.