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Method for measurement of the thermal diffusivity in solids: Application to metals, semiconductors, and thin materials

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We present a method for determining the thermal diffusivity in opaque solids by means of an analysis of the photoacoustic phase signal at low modulation frequencies using the open-cell photoacoustic technique. We show for $f \leqslant (\pi/2)^2 f_c$, where f_c is the modulation frequency at which the thermal diffusion length matches the sample thickness, the photoacoustic phase signal can be written in linear form with the modulation frequency f. Then, obtaining the proportionality coefficient by fitting the experimental data, the thermal diffusivity of the sample can be determined. The advantage of this method is that it is realized in a range of modulation frequencies below those normally used, hence, the photoacoustic signal should be alone attributed to the mechanism of thermal diffusion. Moreover, the signal-to-noise ratio will be more reliable. This method was tested in some samples and it is also shown to be important in solids with high diffusivity values and thin materials. © *1998 American Institute of Physics.*

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thermal diffusivity, semiconductors, metals, thermal conductivity measurement, photoacoustic effect

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A. Rosencwaig and A. Gersho, J. Appl. Phys. **47**, 64 (1976).

F. A. McDonald and G. D. Wetsel, J. Appl. Phys. **49**, 2313 (1978).

G. Rousset, F. Lepoutre, and L. Bertrand, J. Appl. Phys. **54**, 2383 (1983).

L. F. Perondi and L. C. M. Miranda, J. Appl. Phys. **62**, 2955 (1987).

A. Calderón, J. J. Alvarado Gil, Yu. G. Gurevich, A. Cruz-Orea, I. Delgadillo, H. Vargas, and L. C. M. Miranda, Phys. Rev. Lett. **79**, 5022 (1997).

A. M. Mansanares, H. Vargas, F. Galembeck, J. Bujis, and D. Bicanic, J. Appl. Phys. **70**, 7046 (1991).