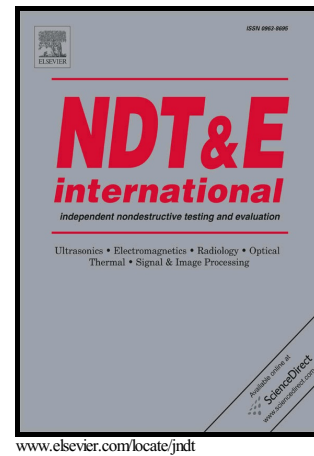


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Simultaneous measurement of the in-plane and in-depth thermal diffusivity of solids using pulsed infrared thermography with focused illumination

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ABSTRACT

We extend the flash method to retrieve simultaneously the principal in-plane and the in-depth thermal diffusivities of anisotropic solids using focused Gaussian illumination. A complete theoretical model allows calculating the temperature rise of an anisotropic and semitransparent sample. The surface temperature distribution has a Gaussian shape along the principal axes, whose radii give the principal in-plane thermal diffusivities. On the other hand, the time evolution of the spatially averaged surface temperature gives the principal in-depth thermal diffusivity. Measurements performed on opaque and semitransparent samples, covering a wide range of thermal diffusivities, validate the method. It is especially suited to characterize the principal components of the thermal diffusivity tensor of anisotropic plates from a single and fast measurement.

Keywords: thermal diffusivity, infrared thermography, flash method, thermal anisotropy.

Highlights:

A front-face flash method with focused illumination is proposed

Simultaneous measurement of in-plane and in-depth thermal diffusivity is obtained

Principal diffusivities of anisotropic plates are got from a single and fast trial

The method is valid for opaque and semitransparent samples

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