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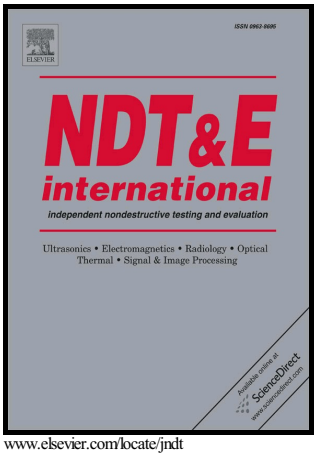

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PII: S0963-8695(15)00110-3
DOI: http://dx.doi.org/10.1016/j.ndteint.2015.10.001
Reference: JNDT1718

To appear in: *NDT and E International*

Received date: 1 June 2015
Revised date: 22 July 2015
Accepted date: 1 October 2015

Cite this article as: Nelson Wilbur Pech-May, Arantza Mendioroz and Agustín Salazar, Simultaneous measurement of the in-plane and in-depth thermal diffusivity of solids using pulsed infrared thermography with focused illumination, *NDT and E International* http://dx.doi.org/10.1016/j.ndteint.2015.10.001

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

Nelson Wilbur Pech-May[a,b], Arantza Mendioroz[a] and Agustín Salazar[a,*]

[a]*Departamento de Física Aplicada I, Escuela Técnica Superior de Ingeniería, Universidad del País Vasco UPV/EHU, Alameda Urquijo s/n, 48013 Bilbao, Spain*

[b]*Department of Applied Physics, CINVESTAV Unidad Mérida, Carretera Antigua a Progreso km6, A.P. 73 Cordemex, Mérida Yucatán 97310, Mexico*

[*] Corresponding author, E-mail: agustin.salazar@ehu.es

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