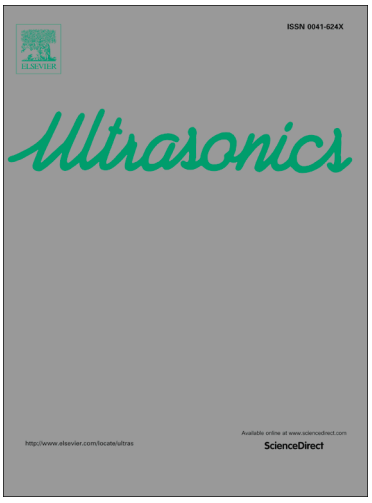

Identification of the mechanical moduli of flexible thermoplastic thin films using reflected ultrasonic waves: Inverse problem

Hacene Lazri, Erick Ogam, Boudour Amar, Z.E.A. Fellah, Andrew O. Oduor, Paul Baki

PII: S0041-624X(17)30451-1
DOI: http://dx.doi.org/10.1016/j.ultras.2017.05.011
Reference: ULTRAS 5541

To appear in: *Ultrasonics*

Received Date: 5 October 2016
Revised Date: 15 May 2017
Accepted Date: 18 May 2017

Please cite this article as: H. Lazri, E. Ogam, B. Amar, Z.E.A. Fellah, A.O. Oduor, P. Baki, Identification of the mechanical moduli of flexible thermoplastic thin films using reflected ultrasonic waves: Inverse problem, *Ultrasonics* (2017), doi: http://dx.doi.org/10.1016/j.ultras.2017.05.011

Identification of the mechanical moduli of flexible thermoplastic thin films using reflected ultrasonic waves: Inverse problem

Hacene Lazri[a], Erick Ogam[b,*], Boudour Amar[a], Z. E. A Fellah[b], Andrew O. Oduor[c], Paul Baki[d]

[a] *Laboratoire d'Elaboration et d'Analyse des Matériaux, Université BADJI Mokhtar Annaba, Algeria*
[b] *Laboratoire de Mécanique et d'Acoustique, CNRS, UPR 7051, Aix-Marseille Univ, Centrale Marseille, F-13453 Marseille Cedex 13, France*
[c] *Maseno University, Department of Physics and Material Sciences, Maseno, Kenya*
[d] *Technical University of Kenya, Faculty of Applied Science and Technology, Haile Selassie Ave, Nairobi, Kenya*

Abstract

A method for the identification of the mechanical moduli and density of flexible, supple thermoplastic thin films placed on elastic substrates using ultrasonic waves has been developed. The composite medium immersed in a fluid host medium (water) was excited using a 50Mhz transducer operating at normal incidence in reflection mode. Inverse problems involving experimental data pertaining to elastic wave propagation in the thin films on their substrates and theoretical fluid-solid interaction models for stratified media using elasticity theory were solved. Two configurations having different interface boundary conditions (BC) were modeled, transverse slip for the sliding contact interface in the case where the thin films were placed on the substrate without bonding; a bonded interface condition. The inverse problem for the recovery of the mechanical parameters were solved for the thin films under the bonded and slip BCs. Substrates made of different elastic materials having different geometries were also evaluated and their advantages discussed.

Keywords: Thin solid flexible films, substrate, ultrasound, Elasticity, layered media, inverse problem, mechanical moduli,

*Principal corresponding author