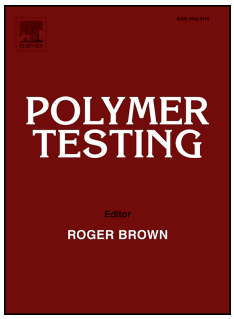

Infrared expandometry: A novel methodology to monitor the expansion kinetics of cellular materials produced with exothermic foaming mechanisms

M. Santiago-Calvo, S. Pérez-Tamarit, J. Tirado-Mediavilla, F. Villafañe, M.A. Rodríguez-Pérez

PII: S0142-9418(18)30040-0

DOI: 10.1016/j.polymertesting.2018.02.004

Reference: POTE 5328

To appear in: *Polymer Testing*

Received Date: 11 January 2018

Revised Date: 30 January 2018

Accepted Date: 3 February 2018

Please cite this article as: M. Santiago-Calvo, S. Pérez-Tamarit, J. Tirado-Mediavilla, F. Villafañe, M.A. Rodríguez-Pérez, Infrared expandometry: A novel methodology to monitor the expansion kinetics of cellular materials produced with exothermic foaming mechanisms, *Polymer Testing* (2018), doi: 10.1016/j.polymertesting.2018.02.004.

Infrared expandometry: a novel methodology to monitor the expansion kinetics of cellular materials produced with exothermic foaming mechanisms

M. Santiago-Calvo [a,*], S. Pérez-Tamarit [a], J. Tirado-Mediavilla [a], F. Villafañe [b], M. A. Rodríguez-Pérez [a]

[a] *Cellular Materials Laboratory (CellMat), Condensed Matter Physics Department, Science Faculty, University of Valladolid, Paseo de Belén, 7, 47011 Valladolid, Spain.*

[b] *GIR MIOMeT-IU Cinquima-Química Inorgánica, Science Faculty, University of Valladolid, Paseo de Belén, 7, 47011 Valladolid, Spain.*

* Corresponding author: mercesc@fmc.uva.es

Abstract

This paper presents a new methodology called "Infrared Expandometry" appropriate to characterize simultaneously the expansion kinetics (height *vs.* time and volume *vs.* time) and the temperature evolution of cellular materials by using the infrared radiation emitted when a body reaches a certain temperature. Therefore, a mandatory feature of the foamed samples to be studied by this methodology is the internal generation of heat during the growing step, i.e. the foaming process must be exothermic. The evolution of the surface temperature *vs.* time is determined by calibrating the intensity of the acquired images. From this information and by using image analysis, the kinetics of foaming is characterized. The presented technique provides very valuable information during the foaming process, such as height, volume, temperature evolution and temperature homogeneity, being a fast, clean and simple characterization technique. In order to demonstrate the use of this new technique to monitor the foaming kinetics of cellular materials, the formation of a polyurethane foam system is herein described.

Keywords: infrared imaging; polyurethane foams; kinetics; foamability

1. Introduction

Polymeric cellular materials have a wide range of applications in different industrial sectors, such as construction, cushioning, packaging, automotive, and many others. In