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PII: S0143-7496(16)30050-1
DOI: http://dx.doi.org/10.1016/j.ijadhadh.2016.03.004
Reference: JAAD1807

To appear in: *International Journal of Adhesion and Adhesives*

Received date: 1 June 2015
Accepted date: 20 February 2016

Cite this article as: A. Chiminelli, R. Breto, M.A. Jiménez, F. Velasco, J. Abenojar and M.A Martínez, EXPERIMENTAL METHOD FOR THE DETERMINATION OF MATERIAL PARAMETERS OF PLASTICITY MODELS FOR TOUGHENED ADHESIVES, *International Journal of Adhesion and Adhesives,* http://dx.doi.org/10.1016/j.ijadhadh.2016.03.004

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Abstract

Toughened adhesives commonly present complex non-linear behaviours affecting the stress/strain distribution that develops in bonded joints under loads and, consequently, influencing their maximum load capacity. Although they can be related to different phenomena, these non-linearities are generally dominated by the plastic yield of the material. For detailed analysis of adhesive joints, these behaviours need to be adequately characterised through proper material models. In this sense, models that take into account the dependency of the yield surface and the plastic potential with the hydrostatic component of the stress tensor have been widely used with certain success in the last years. The definition of such models usually requires the execution of various experimental tests for the determination of the associated material parameters, constituting a significant cost/effort in terms of characterization.

In order to minimize the amount of tests required, the present work is focused on the definition of a sequential/multiaxial test that can be carried out using a single sample giving enough information to completely determine the mentioned parameters. More concretely, the experimental procedure proposed involves torsion and tensile tests that are executed consecutively. The design of the test has been carried out using the finite element method as calculation tool and considering the exponent Drucker-Prager model. The verification of the experimental procedure proposed has been carried out for a toughened epoxy adhesive that has been characterized through conventional tensile and torsion tests in previous works.

Keywords

Adhesives experimental testing, sequential torsion and tensile tests, toughened adhesives, non-linear behaviour, Drucker-Prager model, Finite Element Method.