Accepted Manuscript

Micromechanical modeling of the progressive failure in short glass-fiber reinforced thermoplastics – First Pseudo-Grain Damage model

S. Kammoun, I. Doghri, L. Brassart, L. Delannay

PII: S1359-835X(15)00069-X
DOI: http://dx.doi.org/10.1016/j.compositesa.2015.02.017
Reference: JCOMA 3861

To appear in: *Composites: Part A*

Received Date: 8 August 2014
Revised Date: 7 January 2015
Accepted Date: 22 February 2015

Please cite this article as: Kammoun, S., Doghri, I., Brassart, L., Delannay, L., Micromechanical modeling of the progressive failure in short glass-fiber reinforced thermoplastics – First Pseudo-Grain Damage model, *Composites: Part A* (2015), doi: http://dx.doi.org/10.1016/j.compositesa.2015.02.017

Micromechanical modeling of the progressive failure in short glass-fiber reinforced thermoplastics – First Pseudo-Grain Damage model

S. Kammoun[a,*], I. Doghri[b], L. Brassart[b], L. Delannay[b]

[a] *Université Tunis El Manar, Laboratoire de Génie Civil (LGC), Ecole Nationale d'Ingénieurs de Tunis, BP 37, Le Belvédère, 1002 Tunis, Tunisia*
[b] *Université catholique de Louvain (UCL), IMMC, Bâtiment Euler, 4 Avenue G.Lemaître B-1348 Louvain-La-Neuve, Belgium*

Abstract

This paper presents a new micromechanical damage model, called "First Pseudo-Grain Damage" (FPGD) model, to predict the overall elasto-plastic behavior and damage evolution in short fiber reinforced thermoplastic materials typically produced by injection molding. The model combines mean-field homogenization theory with a continuum damage model, leading to a semi-analytical estimate of the composite incremental response that is convenient for the large scale simulation of composite structures. Each representative volume element (RVE) of the composite is decomposed into a set of pseudo-grains (PGs), which are two-phase composites with aligned fibers of the same aspect ratio. The PGs are homogenized individually according to a nonlinear Mori-Tanaka scheme. Then, a self-consistent scheme is applied to the aggregate of homogenized PGs. An anisotropic damage model is used at the PG level which enables accommodating arbitrary multiaxial and non-monotonic loading histories. Damage evolution inside PGs progressively affects the overall stiffness and strength of the RVE up to total failure. An evaluation of the proposed model against experimental data is conducted for short glass-fiber reinforced polyamide 6,6 (PA6,6). It is shown that the model yields satisfactory predictions of the response

*Corresponding author.Tel.: (+216) 23 058 912 ; fax: (+216) 75 392 190.
Email addresses: slim.kammoun@enig.rnu.tn (S. Kammoun), issam.doghri@uclouvain.be (I. Doghri), laurence.brassart@uclouvain.be (L. Brassart), laurent.delannay@uclouvain.be (L. Delannay)