Accepted Manuscript

Two-scale structural mechanical modeling of long fiber reinforced thermoplastics

Fabian Buck, Barthel Brylka, Viktor Müller, Timo Müller, Kay A. Weidenmann, Andrew N. Hrymak, Frank Henning, Thomas Böhlke

PII: S0266-3538(15)30004-X

DOI: 10.1016/j.compscitech.2015.05.020

Reference: CSTE 6118

To appear in: *Composites Science and Technology*

Received Date: 7 January 2015

Revised Date: 28 May 2015

Accepted Date: 30 May 2015

Please cite this article as: Buck F, Brylka B, Müller V, Müller T, Weidenmann KA, Hrymak AN, Henning F, Böhlke T, Two-scale structural mechanical modeling of long fiber reinforced thermoplastics, Composites Science and Technology (2015), doi: 10.1016/j.compscitech.2015.05.020.

Two-scale structural mechanical modeling of long fiber reinforced thermoplastics

Fabian Buck[a], Barthel Brylka[a], Viktor Müller[a], Timo Müller[b], Kay A. Weidenmann[c], Andrew N. Hrymak[d], Frank Henning[b], Thomas Böhlke[a,*]

[a] *Chair for Continuum Mechanics, Institute of Engineering Mechanics, Karlsruhe Institute of Technology (KIT), Kaiserstraße 10, 76131 Karlsruhe, Germany*
[b] *Chair for Ligthweight Technology, Institute of Vehicle Systems Technology, Karlsruhe Institute of Technology (KIT), Rintheimer-Querallee 2, 76131 Karlsruhe, Germany*
[c] *Section Hybrid and Lightweight Materials, Institute for Applied Materials (IAM-WK), Karlsruhe Institute of Technology (KIT), Engelbert-Arnold-Straße 4, 76131 Karlsruhe, Germany*
[d] *Department of Chemical and Biochemical Engineering, University of Western Ontario, 1151 Richmond Street, London, Ontario, Canada, N6A 3K7*

Abstract

The mechanical properties of long fiber reinforced thermoplastics (LFT), which highly depend on the fiber orientation induced through manufacturing on a direct LFT line, are predicted for compression molded rectangular plates. Therefore, three two-scale structural mechanical simulation schemes are applied and discussed: a two-step approach, the Mori-Tanaka scheme and the self-consistent method. Fiber orientation tensors based on measured micro computed tomography data of selected samples as well as on filling simulations are used for the determination of mechanical properties, as e.g. the storage modulus. The results have been compared with dynamic mechanical analysis measurements of tensile specimens. The influence of the initial strand position on the effective mechanical properties of the plate and the variation of those are examined.

Keywords: A. Long fiber reinforced composites, C. Multiscale modeling, D. Dynamic mechanical analysis

*Corresponding author
Email address: thomas.boehlke@kit.edu (Thomas Böhlke)