Accepted Manuscript

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PII: S1359-8368(17)34298-1

DOI: 10.1016/j.compositesb.2018.01.009

Reference: JCOMB 5500

To appear in: *Composites Part B*

Received Date: 19 December 2017

Accepted Date: 18 January 2018

Please cite this article as: Mattner T, Körbel W, Wrensch M, Drummer D, Compensation of edge effects in picture frame testing of continuous fiber reinforced thermoplastics, *Composites Part B* (2018), doi: 10.1016/j.compositesb.2018.01.009.

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Abstract: In picture frame testing, influences of the clamping and fiber misalignment have been already studied for dry fabrics. Due to the presence of solid regions near the clamps in picture frame tests of thermoplastic continuous fiber reinforced composites at processing conditions, the influences of the clamping are amplified. This study examines the effects of the presence of unmelted material regions near the clamps on picture frame tests both analytically and experimentally for polypropylene glass fiber composite, using a custom built picture frame which allows for an inward and outward repositioning of the clamps. The results show the presence of major strains in the composite samples when unmelted material is present near the clamps which can lead to forces up to 6.5 times higher than for supposedly ideal kinematic conditions. An overadjustment of the clamps by a up to 0.5 % of the joint distance of the picture frame to allow for a minor amount of compression in the composite has shown favorable results which are comparable to correctly corrected measurements. This setting is hence recommended to generate more reliable and comparable results for intra play shear properties of thermoplastic composites. Further research is necessary to additionally account for fiber misalignment.

Keywords: organo-sheet, clamping, measurement error, intra ply shear

1 Introduction

Continuous fiber reinforced composites (CFRCs) are a material family of high current industrial interest, which are, however, still fighting with several problems. In order to be industrially competitive, possibilities of virtual design by simulation respectively numerical analyses are nowadays usually are prerequisite. The direct competitors for CFRCs, especially in regards to lightweight construction, are more traditional materials such as aluminum, special high-strength steel grades or other high tech plastics. While for most competitors, predominantly for aluminum, high simulative accuracies are state of the art and simulations are extensively used as an aid in research [1][2][3], simulations of CFRCs are still far behind in accuracy and research is mostly centered on the creation of feasible simulation approaches and material modelling [4][5][6]. A major challenge in relation to the simulation of CFRCs is the generation of valid material data, as the material behavior is highly anisotropic and locally inhomogeneous. Out of all modes of deformation of CFRCs – tensile properties, bending properties, intra-laminar shear, inter-laminar shear and others – the intra-laminar shear is of major relevance [7]. To assess the intra-laminar shear properties of CFRCs, primarily two different test setups are established, the bias-extension test and the picture frame test. A lot of effort has been invested into the research and comparison of both tests [8][9][10], both on the level of dry fabrics and thermoplastic composites (usually referred to as organo-sheets), but several