Accepted Manuscript

Analysis of the 3D draping behavior of carbon fiber non-crimp fabrics with eddy current technique

Georg Bardl, Andreas Nocke, Matthias Hübner, Thomas Gereke, Matthias Pooch, Martin Schulze, Henning Heuer, Marko Schiller, Richard Kupke, Marcus Klein, Chokri Cherif

PII: S1359-8368(17)30321-9

DOI: 10.1016/j.compositesb.2017.08.007

Reference: JCOMB 5232

To appear in: *Composites Part B*

Received Date: 26 January 2017

Revised Date: 29 May 2017

Accepted Date: 2 August 2017

Please cite this article as: Bardl G, Nocke A, Hübner M, Gereke T, Pooch M, Schulze M, Heuer H, Schiller M, Kupke R, Klein M, Cherif C, Analysis of the 3D draping behavior of carbon fiber non-crimp fabrics with eddy current technique, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.08.007.

Analysis of the 3D draping behavior of carbon fiber non-crimp fabrics with eddy current technique

Georg Bardl[a*], Andreas Nocke[a], Matthias Hübner[a], Thomas Gereke[a], Matthias Pooch[b], Martin Schulze[b], Henning Heuer[b,c], Marko Schiller[d], Richard Kupke[e], Marcus Klein[e], Chokri Cherif[a]

[a] Institute of Textile Machinery and High Performance Material Technology (ITM), TU Dresden. Dresden, Germany

[b] Fraunhofer Institute for Ceramic Technology and Systems, Material Diagnostic (IKTS-MD). Dresden, Germany

[c] Electronic Packaging Laboratory, Chair of Sensor Systems for Non-Destructive Testing, TU Dresden. Dresden, Germany

[d] HTS GmbH. Coswig, Germany

[e] SURAGUS GmbH. Dresden, Germany

* Corresponding author. ITM TU Dresden, Hohe Str. 6, 01069, Dresden, Germany. Tel.: +49-351-463-33766, Fax +49-351-463-34026. E-mail address: georg.bardl@tu-dresden.de

Abstract

Assessing and controlling the complex deformation behavior of textile reinforcements fabrics remains one of the major challenges in the production of fiber-reinforced plastics. In this paper, the draping of +45°/-45° biaxial non-crimp fabrics to a hemispherical shape is investigated with an eddy current imaging technique. After an automated draping process, the textiles are scanned with a robot-guided eddy current measurement system. From the resulting conductivity maps of the samples, the local yarn directions are extracted by image analysis and the paths of individual yarns are reconstructed for both the upper and the lower layer. Experiments are carried out for different forming speeds, blank holder forces and different non-crimp fabric parameters (stitch length, stitch type, stitch tension and yarn count). The influences of these parameters are compared and discussed, with the conclusion that blank holder forces have by far the most significant influence on the draping result. Sample experimental results are compared to results from an FEM draping simulation.