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Kristine M. Jespersen, Jens Zangenberg, Tristan Lowe, Philip J. Withers, Lars P. Mikkelsen

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Kristine M. Jespersen[a,*], Jens Zangenberg[b], Tristan Lowe[c], Philip J. Withers[c], Lars P. Mikkelsen[a]

[a] *Department of Wind Energy, Composites and Materials Mechanics, Technical University of Denmark, DTU Risø Campus, 4000 Roskilde, Denmark*
[b] *LM Wind Power Blades, Composite Mechanics, Jupitervej 6, 6000 Kolding, Denmark*
[c] *Manchester X-ray Imaging Facility, School of Materials, University of Manchester, Manchester M13 9PL, United Kingdom*

Abstract

In this study, the progression of tension-tension fatigue (R=0.1) damage in a uni-directional (UD) composite made from a non-crimp glass fibre fabric used for wind turbine blades is investigated using multi-scale 3D X-ray computed tomography (CT). Initially, a representative volume is examined at one specific damage level. UD fibre fractures are only observed close to the supporting thin transverse backing layers. Furthermore, UD fibre fractures are only observed at locations where backing fibre bundles intersect one another and are at the same time locally close to a UD bundle. In addition, to study the progression of damage as a function of stiffness degradation at higher resolution four samples are subjected to different numbers of cycles before examination by CT. One sample is examined during the initial stiffness drop, two samples during stable stiffness degradation, and one close to final failure. Damage is observed to occur as chains of individual fibre breaks or clusters of fibre fractures rather than large fracture planes. Our work indicates how fracture of UD fibres initiates from intersecting ±80° backing bundles extending progressively further into the UD layer. The fibre fracture zone becomes more diffuse further from the backing layer. Our work supports

* Corresponding author. Tel.: +45 28250993.
E-mail address: kmun@dtu.dk (K.M. Jespersen).