Data in Brief 6 (2016) 680–695

Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data Article

Characterisation of the mechanical and fracture properties of a uni-weave carbon fibre/epoxy non-crimp fabric composite

Thomas Bru [a,b,*], Peter Hellström [a], Renaud Gutkin [a], Dimitra Ramantani [a], Göran Peterson [c]

[a] Swerea SICOMP, P.O. Box 104, 431 22 Mölndal, Sweden
[b] Division of Material and Computational Mechanics, Department of Applied Mechanics, Chalmers University of Technology, SE-412 96 Göteborg, Sweden
[c] Volvo Group Trucks Technology, Department 26547, AB2V, 405 08 Göteborg, Sweden

ARTICLE INFO

Article history:
Received 29 December 2015
Accepted 7 January 2016
Available online 15 January 2016

Keywords:
Polymer matrix composite
Carbon fibre
Non-crimp fabric
Mechanical testing
Mechanical properties
Stress/strain curve
Fracture toughness

ABSTRACT

A complete database of the mechanical properties of an epoxy polymer reinforced with uni-weave carbon fibre non-crimp fabric (NCF) is established. In-plane and through-the-thickness tests were performed on unidirectional laminates under normal loading and shear loading. The response under cyclic shear loading was also measured. The material has been characterised in terms of stiffness, strength, and failure features for the different loading cases. The critical energy release rates associated with different failure modes in the material were measured from interlaminar and translaminar fracture toughness tests. The stress–strain data of the tensile, compressive, and shear test specimens are included. The load–deflection data for all fracture toughness tests are also included. The database can be used in the development and validation of analytical and numerical models of fibre reinforced plastics (FRPs), in particular FRPs with NCF reinforcements.

* Corresponding author.
E-mail addresses: thomas.bru@swerea.se (T. Bru), peter.hellstrom@swerea.se (P. Hellström), renaud.gutkin@swerea.se (R. Gutkin), dimitra.ramantani@swerea.se (D. Ramantani), goran.peterson.2@volvo.com (G. Peterson).

http://dx.doi.org/10.1016/j.dib.2016.01.010

Specifications Table

Subject area	*Composite materials*
More specific subject area	*Material characterisation/mechanics of composite materials*
Type of data	*Table and graphs, pictures*
How data was acquired	*Universal testing machines, strain gauges* (*Showa N22-FA-5-120-11-VS2 for the in-plane tensile tests, Kyowa KFG-3-120-C1-11L3M3R for the compressive tests and through-the-thickness tensile tests*), *DIC system (ARAMIS 2M*(*-5M*) *from GOM GmbH*), *travelling microscope*
Data format	*Raw data in CSV format and post-processed data in tables and graphs*
Experimental factors	*Mechanical and fracture properties a uni-weave NCF composite material*
Experimental features	*Stress/strain response, stiffness, strength, fracture toughness, failure features*
Data source location	*Sweden*
Data accessibility	*Data are included in this article*

Value of the data

- This data set presents a complete mechanical characterisation of a CFRP system.
- The data can be used as input properties in analytical models.
- The data can be used as input parameters in finite element analyses and used for validation of results.
- The data can be compared to already available data for others CFRPs. The data can also be used in the development of future CFRPs, in particular those with NCF reinforcements.
- Guidelines for the mechanical and fracture characterisation of a given FRP material are provided.

1. Data

The stress–strain curves under the following loading cases are presented:

- in-plane longitudinal tension
- in-plane longitudinal compression
- in-plane transverse tension
- in-plane transverse compression
- through-the-thickness (TT) tension
- TT compression
- in-plane shear
- TT shear

The following terminology is used: 1-index refers to the longitudinal (to the fibre) direction in the reinforcement plane, 2-index refers to the transverse direction in the reinforcement plane, and 3-index refers to the TT direction w.r.t. the reinforcement plane. The stiffness and strength values are extracted from the stress–strain curves, and the specimen failure features reported.

Abbreviations: Avg, average; CC, compact compression; CFRP, carbon fibre reinforced plastic; CNC, computer numerical control; CT, compact tension; CV, coefficient of variation; DCB, double cantilever beam; DIC, digital image correlation; ENF, end notched flexure; FRP, fibre reinforced plastic; FVF, fibre volume fraction; MMB, mixed-mode bending; NCF, non-crimp fabric; NL, nonlinearity method; Peak, maximum peak method; *R*-curve, crack resistance curves; RTM, resin transfer moulding; TT, through-the-thickness; VI, vacuum infusion; VO, visual observation method