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Data Article

X-ray tomography data of compression tested unidirectional fibre composites with different off-axis angles

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A B S T R A C T

This data article contains lab-based micro-computed tomography (µCT) data of unidirectional (UD) non-crimp fabric (NCF) carbon fibre reinforced composite specimens that have been deformed by compression. The specimens contain UD fibres with off-axis angles of 0°, 5°, 10°, 15° and 20° and the compression testing induces kink-band formation. This data formed the basis for the analysis of the influence of in-plane shear on kink-plane orientation as reported in Wilhelmsson et al. (Wilhelmsson et al., 2019).

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1. Data

The data presented in this paper consist of 10 X-ray tomography datasets of unidirectional (UD) non-crimp fabric (NCF) carbon fibre reinforced composites. The difference between the datasets is the off-axis angle of the UD fibres which are 0°, 5°, 10°, 15° and 20°. The off-axis angle is the angle between the UD fibres and the compression axis. The off-axis orientation is illustrated in the 5 cross sections...
through the reconstructions in Figs. 1–5. Each sample has been scanned with a field of view of 13 mm (FOV 13 mm) and a field of view of 3 mm (FOV 3mm). The raw projection data is in the “.txrm” format and the reconstructed data is available in both the “.txm” and the “.tif” format. The “.txrm” and “.txm” format are the regular output formats for the raw and reconstructed image data of the Zeiss Xradia 520 Versa system used for the data acquisition. The dataset also includes three movies of each reconstructed dataset in which the volumetric data is sectioned in the XY, XZ, YZ planes.

2. Experimental design, materials, and methods

The specimens that have been tomographically scanned consist of UD fibers with off-axis angles of 0°, 5°, 10°, 15° and 20°. The reader is referred to [1] for a detailed description of how the samples were manufactured. The tomography scans were performed on a Zeiss Xradia 520 Versa. The X-ray scanner was equipped with a tungsten target. An acceleration voltage of 30kV and a power of 7mA was applied to generate X-rays with energies up to 30 keV. Projections were acquired during a full 360° rotation of the specimens. The detector size was 2k × 2k and projection images with a binning of 2 were acquired to increase the signal to noise ratio. A Feldkamp reconstruction algorithm [2] for cone beam
Fig. 1. Cross sections through the reconstructed specimen with UD fibres with off-axis angles of 0° through (a) XY plane in FOV 13 mm, (b) XY plane in FOV 3 mm, (c) XZ plane in FOV 13 mm, (d) XZ plane in FOV 3 mm. The blue box in (a) and (c) mark the position of the FOV 3 mm scan in (b) and (d). The fibre direction, indicating the off-axis angle, is marked in (a) and (b) with a white arrow.
Fig. 2. Cross sections through the reconstructed specimen with UD fibres with off-axis angles of $5^\circ$ through (a) XY plane in FOV 13 mm, (b) XY plane in FOV 3 mm, (c) XZ plane in FOV 13 mm, (d) XZ plane in FOV 3 mm. The blue box in (a) and (c) mark the position of the FOV 3 mm scan in (b) and (d). The fibre direction, indicating the off-axis angle, is marked in (a) and (b) with a white arrow.
Fig. 3. Cross sections through the reconstructed specimen with UD fibres with off-axis angles of 10° through (a) XY plane in FOV 13mm, (b) XY plane in FOV 3 mm, (c) XZ plane in FOV 13 mm, (d) XZ plane in FOV 3 mm. The blue box in (a) and (c) mark the position of the FOV 3 mm scan in (b) and (d). The fibre direction, indicating the off-axis angle, is marked in (a) and (b) with a white arrow.
Fig. 4. Cross sections through the reconstructed specimen with UD fibres with off-axis angles of 15° through (a) XY plane in FOV 13 mm, (b) XY plane in FOV 3 mm, (c) XZ plane in FOV 13 mm, (d) XZ plane in FOV 3 mm. The blue box in (a) and (c) mark the position of the FOV 3 mm scan in (b) and (d). The fibre direction, indicating the off-axis angle, is marked in (a) and (b) with a white arrow.
Fig. 5. Cross sections through the reconstructed specimen with UD fibres with off-axis angles of 20° through (a) XY plane in FOV 13 mm, (b) XY plane in FOV 3 mm, (c) XZ plane in FOV 13 mm, (d) XZ plane in FOV 3 mm. The blue box in (a) and (c) mark the position of the FOV 3 mm scan in (b) and (d). The fibre direction, indicating the off-axis angle, is marked in (a) and (b) with a white arrow.
reconstructions were applied resulting in 3D reconstructions with voxel sizes of 12.77 \( \mu \text{m} \) and 3.02 \( \mu \text{m} \) for the FOV 13mm and FOV 3mm scans, respectively. All relevant scan parameters are listed in Table 1.

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### Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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