

BIAXIAL PLAIN AND OPEN-HOLE STRENGTH OF THERMOPLASTIC COMPOSITES

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ABSTRACT

Thermoplastic composites are gaining momentum in the aviation industry as they enable new manufacturing techniques that can greatly benefit cost-efficient high-volume production, while at the same time enhancing sustainability. There are however difficulties in exploiting the full potential of composites materials, in particular under multi-axial loading.

The objective of this work is to test the plain- and open-hole strength of thermoplastic AS4D/PEKK-FC UD composite laminates under multi-axial loading. Cruciform specimens are designed for three different layups: (1) Quasi-isotropic [1], (2) Soft, (3) Hard. The biaxial test program covers various biaxial load combinations in tension-tension, tension-compression and compression-compression. For compression loading, a specially designed anti-buckling fixture is developed. Digital Image Correlation (DIC) is performed to determine the strains at failure and fracture process at the center of the cruciform specimen as shown in Figure 1. The experimental data is evaluated to determine the plain- and open-hole biaxial failure envelopes.

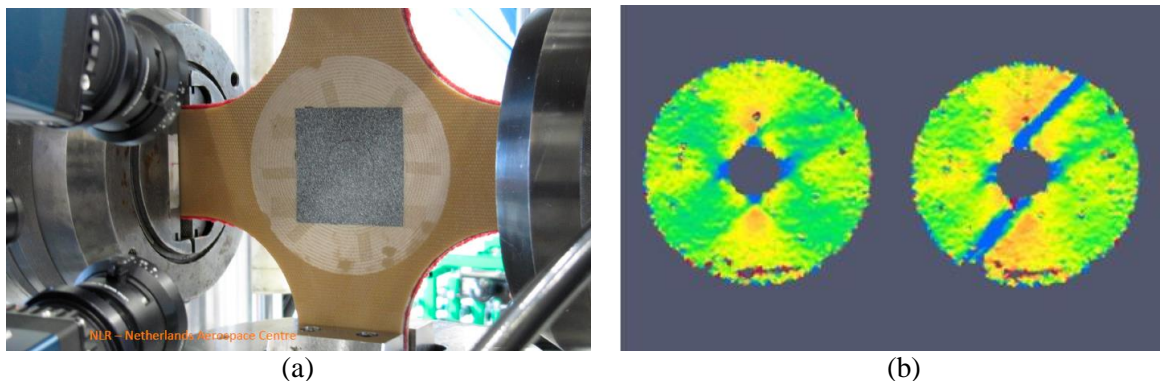


Figure 1: Biaxial test at NLR: (a) Cruciform specimen; (b) DIC open-hole (tension-compression).

REFERENCES

- [1] Vankan WJ, Tijs BHAH, De Jong GJ, De Frel HC, Singh NK. Strength of notched and un-notched thermoplastic composite laminate in biaxial tension and compression. *Journal of Composite Materials* 2016;50(25). doi:10.1177/0021998315621963.