Current trends and applications of multiaxial non-crimped fabrics

Jürgen Tröltzsch*†[1] and Paul Penzel‡[2]

[1]KARL MAYER Technische Textilien GmbH – Germany
[2]Institute of Textile Machinery and High Performance Material Technology – Germany

Abstract

Multiaxial non-crimp fabrics (NCFs) are among the most important textile reinforcements for highly loaded lightweight composite structures. Owing to their highly productive manufacturing process, which combines continuous fiber placement with warp-knitting technology for layer fixation, NCFs have become the industry standard in large-scale applications such as the reinforcement of wind turbine blades, transportation systems, and structural composite components.
By utilizing fiber spreading technologies and multiaxial tape placement, the reinforcement potential of advanced fibers can be exploited much more efficiently than in conventional textile structures. This enables the production of tailored reinforcement architectures that are precisely adapted to the load paths and functional requirements of the final component. While glass and carbon fibers currently dominate industrial applications, there is increasing interest in high-performance polymer fibers such as aramid and ultra-high-molecular-weight polyethylene (UHMWPE). Furthermore, the growing demand for sustainable composite solutions has accelerated the development of NCFs based on natural fibers, including hemp and flax, as well as recycled carbon fibers.
Current research and development efforts focus on the next generation of multiaxial fabric manufacturing technologies. A key objective is the replacement of conventional stitch-based knitting yarn layer fixation by stitch-minimized up to stitch-free free bonding concepts and the processing of pre-stabilized tapes containing thermoplastic binders. These approaches aim to further increase the mechanical performance of composite structures by minimizing fiber damage and eliminating disturbances caused by knitting yarns.

Keywords: non, crimp fabric, fiber reinforced composites, multiaxial reinforcement, high, performance fiber systems

*Speaker
†Corresponding author: Juergen.Troeltzsch@karlmayer.com
‡Corresponding author: paul.penzel@tu-dresden.de