Cordage Institute's 2026 Technical Presentation Abstracts

The Cordage Institute Technical Operating Committee is pleased to announce the selection of technical presentations for the Eurocord and Cordage Institute 7th Joint Conference. These presentations will complement Eurocord's selected presentations and help conclude the Joint Conference.

The presentations scheduled for Wednesday, June 17 were carefully chosen to align with the committee's aim of addressing current and significant topics concerning fiber ropes, cables, chains, and other synthetic tension members.

Emerging Low-Creep HMPE Fiber Technologies in China: An Interim Comparative Assessment

Yuhua Wang, Bingbing Hou, Tingting Huang, Jingbo Ji, Yanxi Li, Rafael Chou
Zhejiang Four Brothers Rope Co., Ltd.
Donghua University

The global HMPE fiber landscape is undergoing a structural transition driven by increasing demand for improved creep resistance in long-term load-bearing applications. Historically, low-creep HMPE solutions were limited to a small number of producers and were largely defined by proprietary supplier technologies, most notably following the introduction of Dyneema® DM20.

Over the past five to six years, a growing number of Chinese HMPE fiber manufacturers have initiated independent development programs targeting low-creep performance. This development trajectory reached an important milestone in 2025 with the publication of China's first industry standard for low-creep HMPE fiber, formally establishing performance criteria and test requirements beyond individual supplier specifications. The release of this standard marks a shift toward a more multi-polar and standardized framework for evaluating low-creep HMPE technologies.

This presentation provides an interim technical assessment based on extensive comparative laboratory data. The analysis integrates shared, multi-source industry datasets together with internally generated test results, applying both standardized methods and proprietary long-term evaluation protocols. This approach enables direct comparison between emerging Chinese low-creep HMPE fibers and established benchmarks, focusing on key parameters including creep resistance, tensile strength retention, load-holding stability, and performance consistency under sustained loading.

In addition to highlighting performance improvements, this work explicitly examines observed gaps, limitations, and trade-offs associated with current low-creep HMPE developments, including variability, processing sensitivity, and long-term behavior under realistic service conditions. While definitive conclusions require continued long-duration testing, the interim data reveal clear performance trends with immediate relevance to rope designers, manufacturers, and end users.

The findings have direct implications for critical applications such as offshore mooring, heavy-lift systems, and other demanding load-holding use cases, as well as for ongoing discussions around material qualification and standardization. By grounding the discussion in shared empirical data rather than supplier claims, this presentation aims to support a more rigorous and transparent industry dialogue on the evolving role of low-creep HMPE fibers in global rope and load-bearing system design.

Heat Effects on Fibers and Ropes

John Flory
Tension Technology International

This talk will discuss how elevated temperature can affect the properties of synthetic fiber ropes

It is inspired by the Huntleys' 2026 OIPEEC paper "Synthetic Mooring Line Failure Analysis", which demonstrated significant heat-related strength loss in HMPE mooring lines.

It will mention other incidents in which elevated temperature is a suspected cause of deterioration in HMPE, nylon and polyester fiber ropes.

It will illustrate how heat is generated within the rope by hysteresis, internal friction and external friction and how it is dissipated from the rope by transfer, convection and radiation

It will discuss how heat can affect fiber rope strength (tenacity), stiffness (modulus) and stretch (creep).

These potential heat effects should be considered when developing and conducting fiber rope test methods.

Heat effects should be demonstrated and quantified through appropriate testing of synthetic fibers and ropes.

Internal Scanning and Condition Monitoring of Synthetic Rope

Elizabeth Huntley
Whitehill Manufacturing

The Bellwether™ synthetic rope scanning device was developed to sense anomalies and changes to internal rope structures due to usage and wear. The device has been used to collect field data on tanker mooring lines for six years and 6000+ mooring hours. Scan signals have been correlated to specific types of damage, wear, and residual strength. A second-generation device has recently been released to increase functionality and ease of use in the field. The new version can be coupled with an external camera system to conduct internal and external inspections simultaneously.

Damage Characterization in Aramid Fiber Ropes Using Micro-CT and Spectroscopic Methods

Dr. T. Mishra, Dr. O. Allan, Prof. dr. ir. M.B. de Rooij, Ir. B.G.A. Rolink, and Dr. ir. B. Cornelissen
Surface Technology & Tribology, Faculty of Engineering Technology, University of Twente
Teijin Aramid BV, Arnhem

Characterization of contact properties such as pressure and slip in the contacting interfaces is key to the understanding of damage mechanics and accurate lifetime prediction in industrial ropes. For several loading applications and rope constructions, damage is initiated and localized predominantly at the internal rope interfaces. Most experimental techniques to measure pressure, slip and damage in ropes are typically invasive and therefore are limited to external surface indicators. Recent developments in lab-scale imaging such as micro-CT scanning have been used to investigate these internal rope interfaces. However, analysis and quantification methods for implementing and extending these tools to image filaments at high resolution for measuring slip and damage at the filament scale are still lacking. Moreover, applying these lab-scale tools to in-line diagnostics of damage propagation in industrial ropes is quite challenging.

In our recent research, we have integrated several novel experimental methods to characterize pressure, slip and damage at the internal rope interfaces in three-strand aramid fiber ropes. We have used pressure-films to measure contact pressure and width between strands in three-strand aramid fiber ropes with different twist constructions and sizes under tensile loads. We have integrated machine learning with high resolution micro-CT imaging to characterize the orientation and packing of filaments in the strands (see Figure 1). We have developed an algorithm to compute relative slip between filaments by mapping centroid displacements at in-situ incremental loading. These experimental measurements have helped extend and validate analytical models to estimate internal damage distribution due to friction and slip between filaments across rope interfaces. Furthermore, we have successfully investigated the use of infrared spectroscopy (ATR-FTIR) as an in-line, non-invasive, damage indicator tool by studying the spectral absorbance patterns against increasing damage levels in both twisted and untwisted rope samples after cyclic bending tests (see Figure 2).

In conclusion, all these characterization techniques have provided us with a deeper understanding of damage propagation at the strand interfaces both at filament detail level. Our methods can be further extended to study more complex rope constructions in large-scale industrial ropes under varied loading conditions. Eventually with our developed techniques and damage indicator algorithms, we can more accurately estimate the lifetime of ropes by in-line diagnostics, thereby significantly improving the safety, cost-savings and circularity in the fiber rope industry.

Keywords: *Aramid, Laid ropes, Pressure films, CT scan, FTIR, rope damage, rope lifetime*.

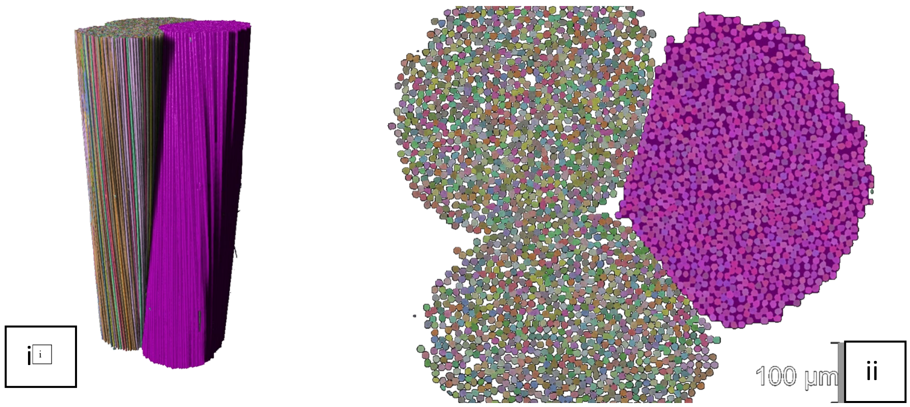

***Figure 1**. (i) 3D image of a three-strand rope constructed from micro-CT scans. (ii) Cross-section of the 3D scan, highlighting the identified regions of interest for the individual filaments and one of the strands (highlighted in purple).*

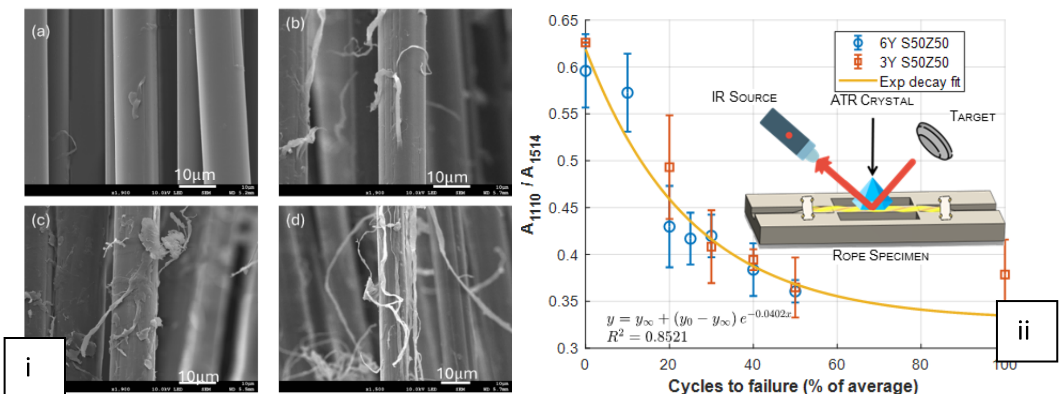

***Figure 2.** (i) SEM images of Twaron® yarns in a three-strand rope at 50% of average bending of sheave life highlighting different damage levels (a-d). (ii) Normalized absorbance ratio of wavenumbers 1110 cm^{-1} and 1514 cm^{-1}: A_{1110}/A_{1514} as a function of % of average cycles to failure, as obtained from ATR-FTIR of a twisted (closed) three-strand rope.*

Contributions: O. Allan: Experimental work, analysis, writing; T. Mishra: Daily supervision, writing, co-promotor; M.B. de Rooij: overall supervision, promotor; B.G.A. Rolink: industry client, expert advisor; B. Cornelissen: industry supervisor, expert advisor.

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