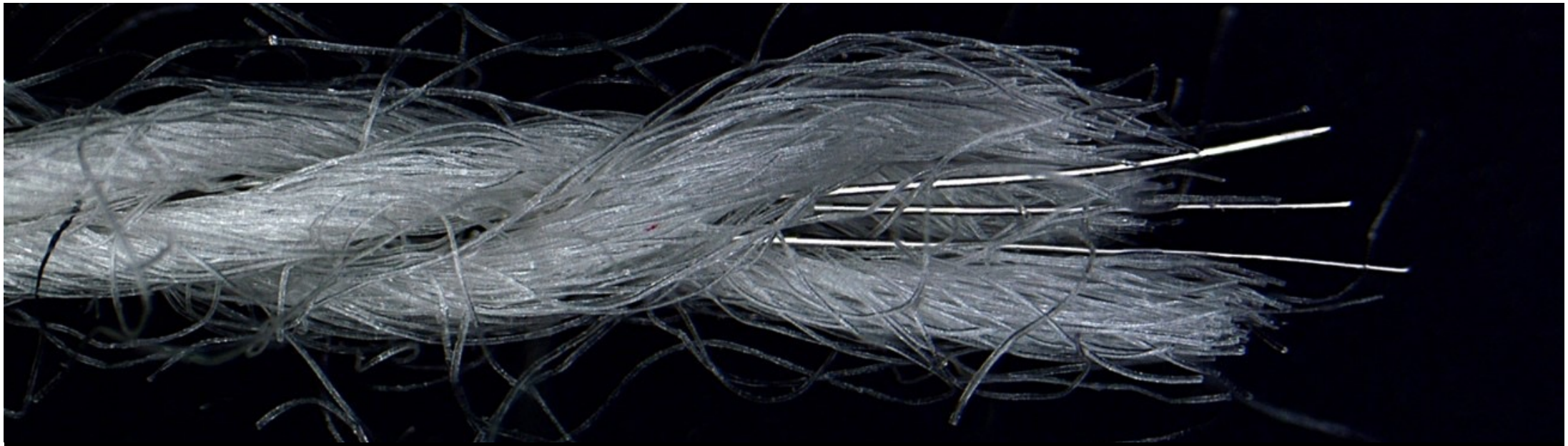


A Comprehensive Characterization of Commercial Conductive Yarns for Smart Textile Applications

Aftab Ahmed[1], Mira Haberfellner[1], Federica Morandi[1], Thomas Preindl[1], Andreas Pointner[1], Anita Vogl[2], Cohen Nitzan[1], Andrea Gasparella[1], Niko Münzenrieder[1], and Michael Haller[1]

[1] Faculty of Engineering, Free University of Bozen-Bolzano

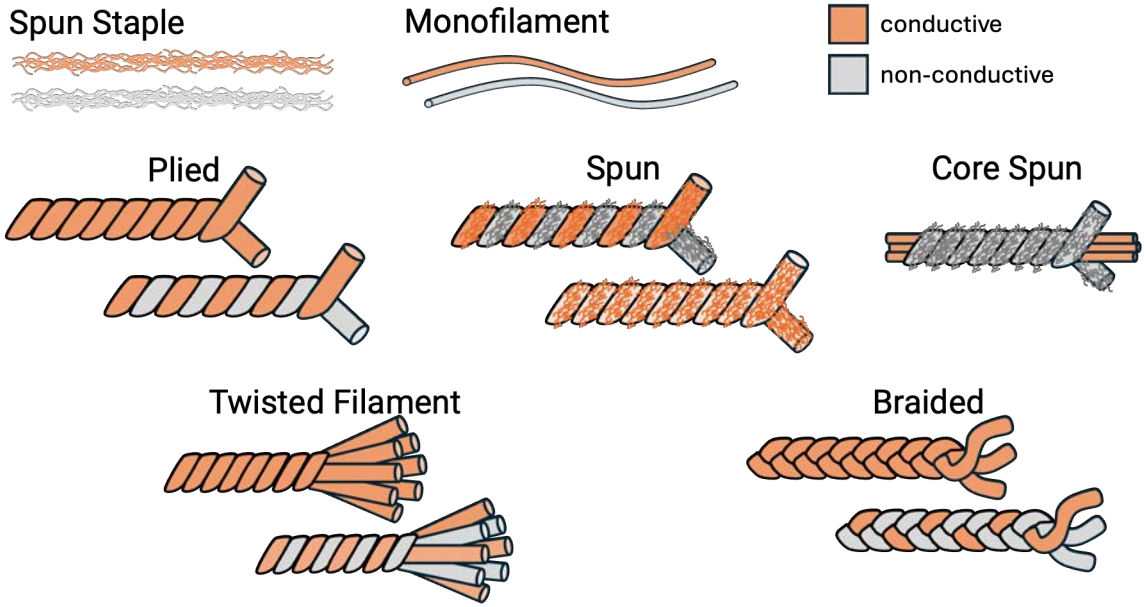
[2] University of Applied Sciences Upper Austria

Challenges

Which yarn is best for embroidery?

Introduction

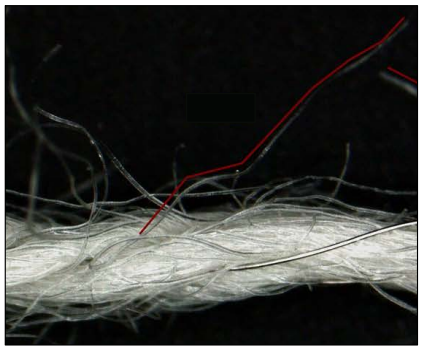
- Commercial yarns vary widely in structure and materials
- Characterize conductive yarns for embroidery

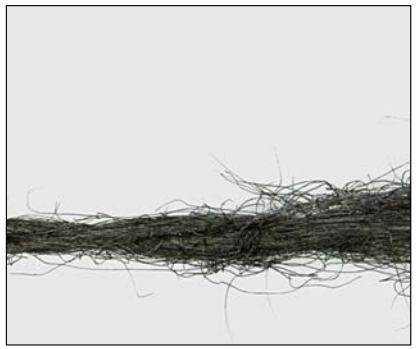


Objectives

- Characterization of commercial conductive yarns

- Analyse structural parameters (thickness, hairiness)

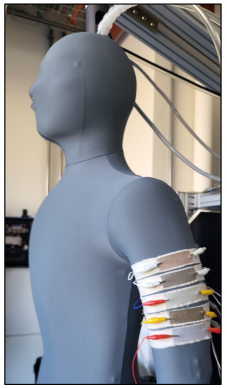




Objectives

- Evaluate thermal performance via heat chamber and manikin testing

- Establish a standardized assessment framework



Materials

Materials

- Spun
- Plied spun
- Core spun
- Multifilament
- Twisted filaments

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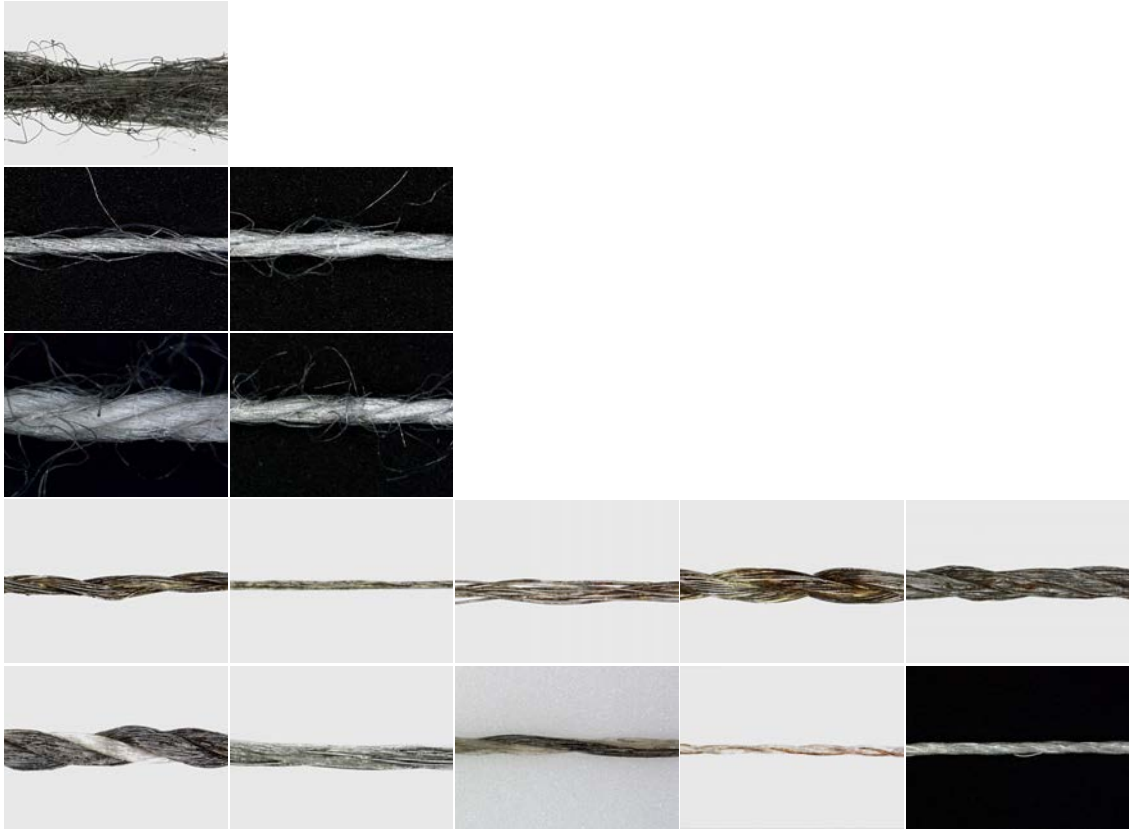

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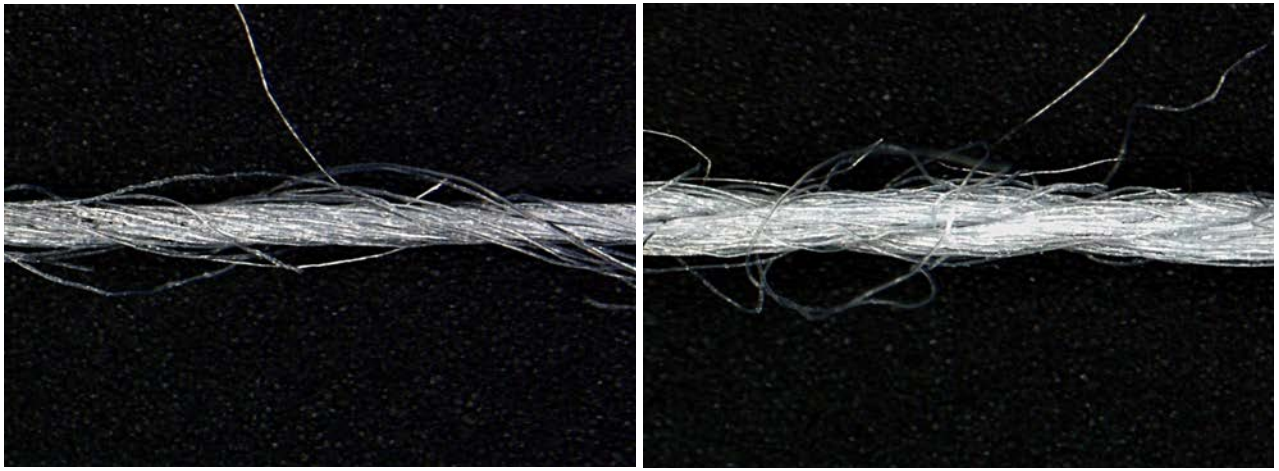

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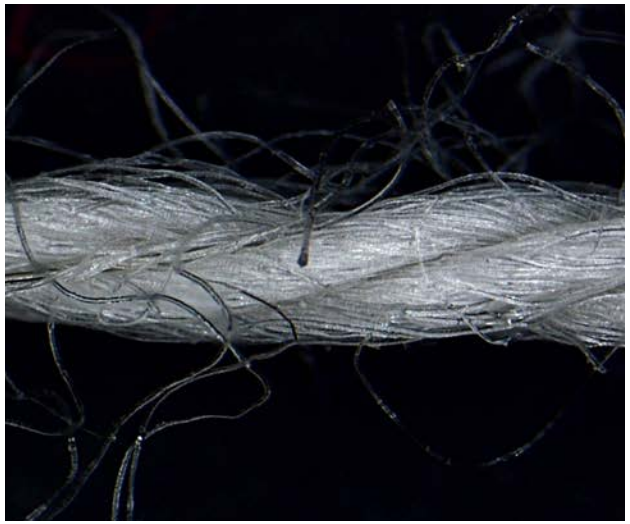

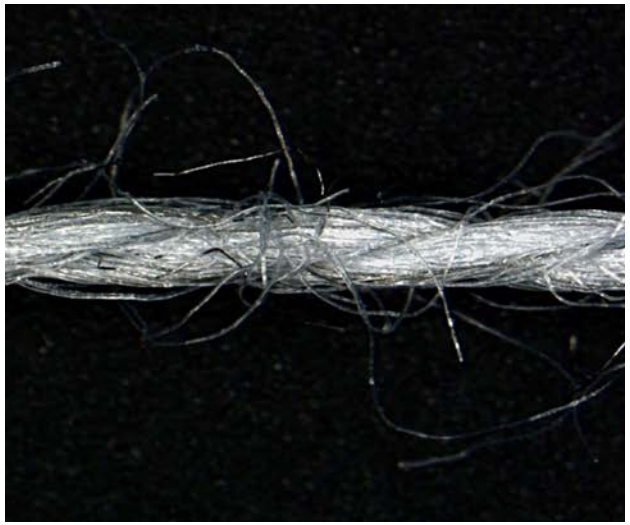

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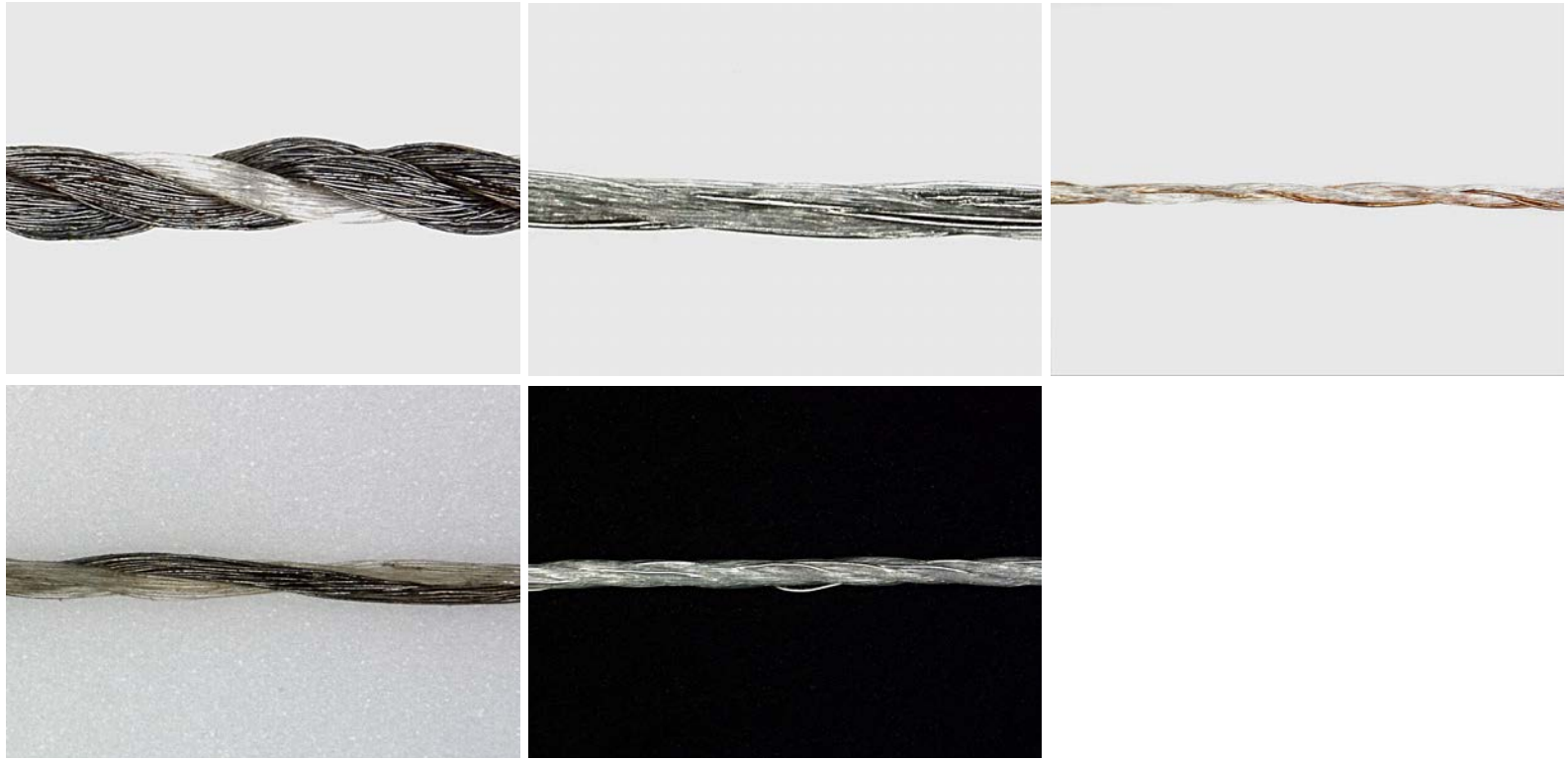
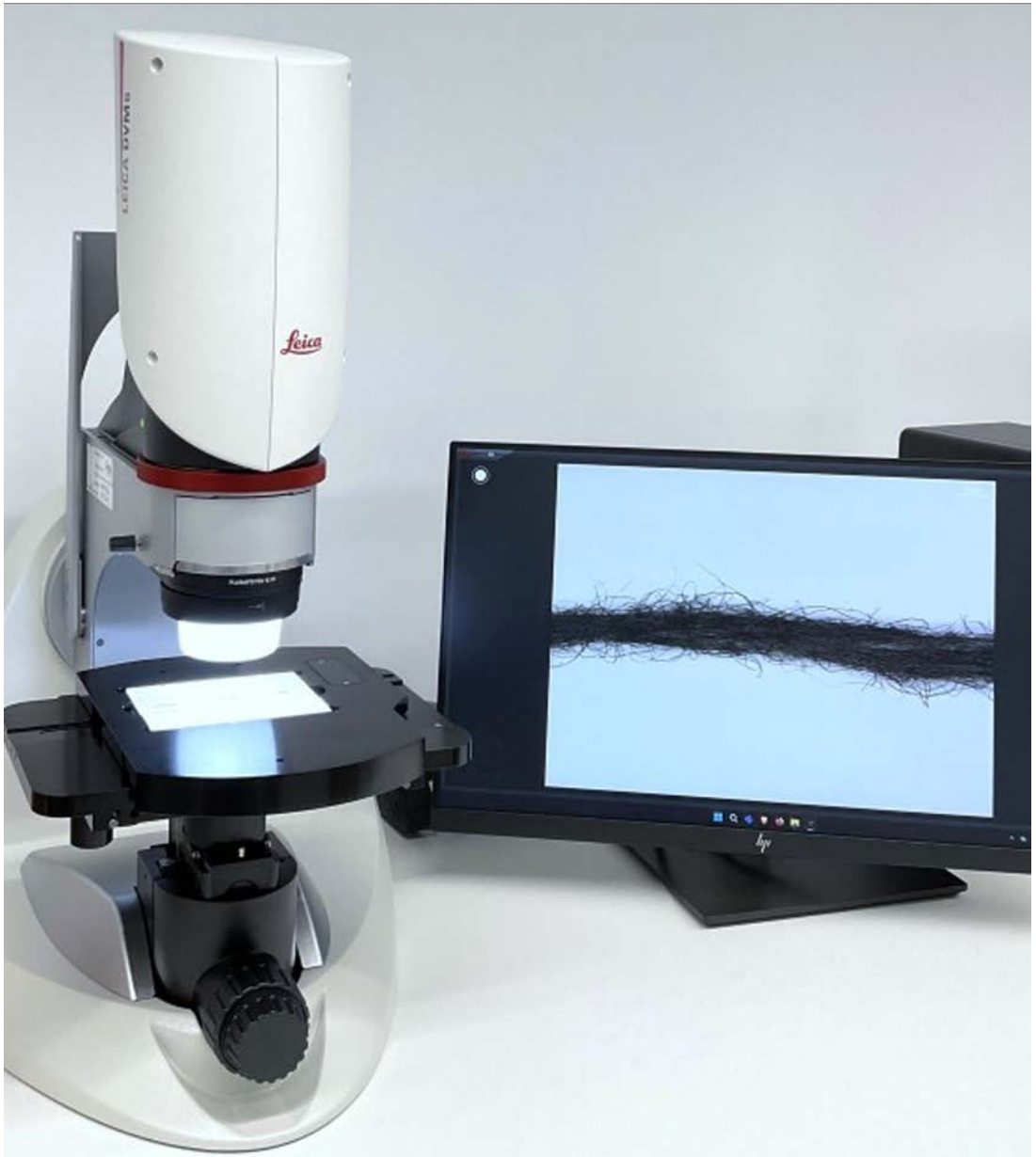


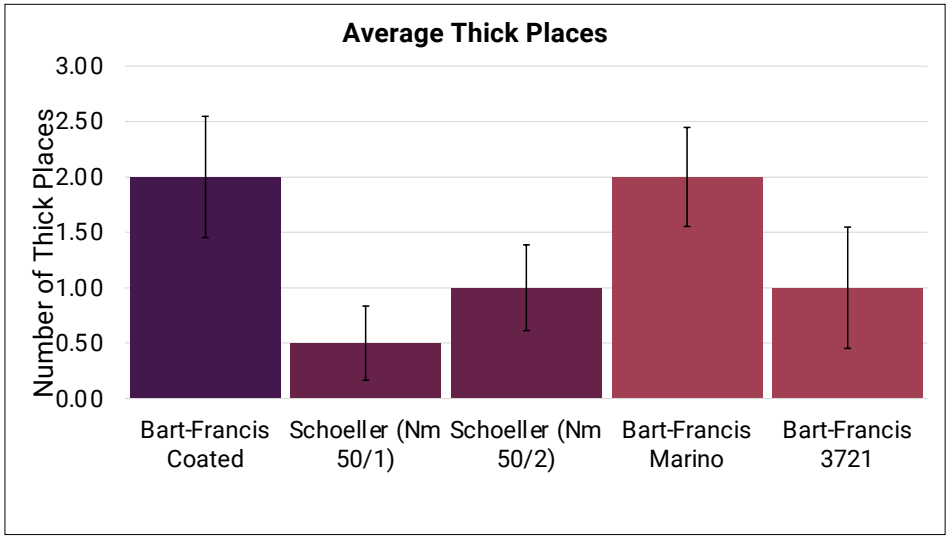
Hairiness

The Leica DVM6 microscope was used to examine the conductive yarns' structure

Comparing each measurement to the average diameter



Thick Places



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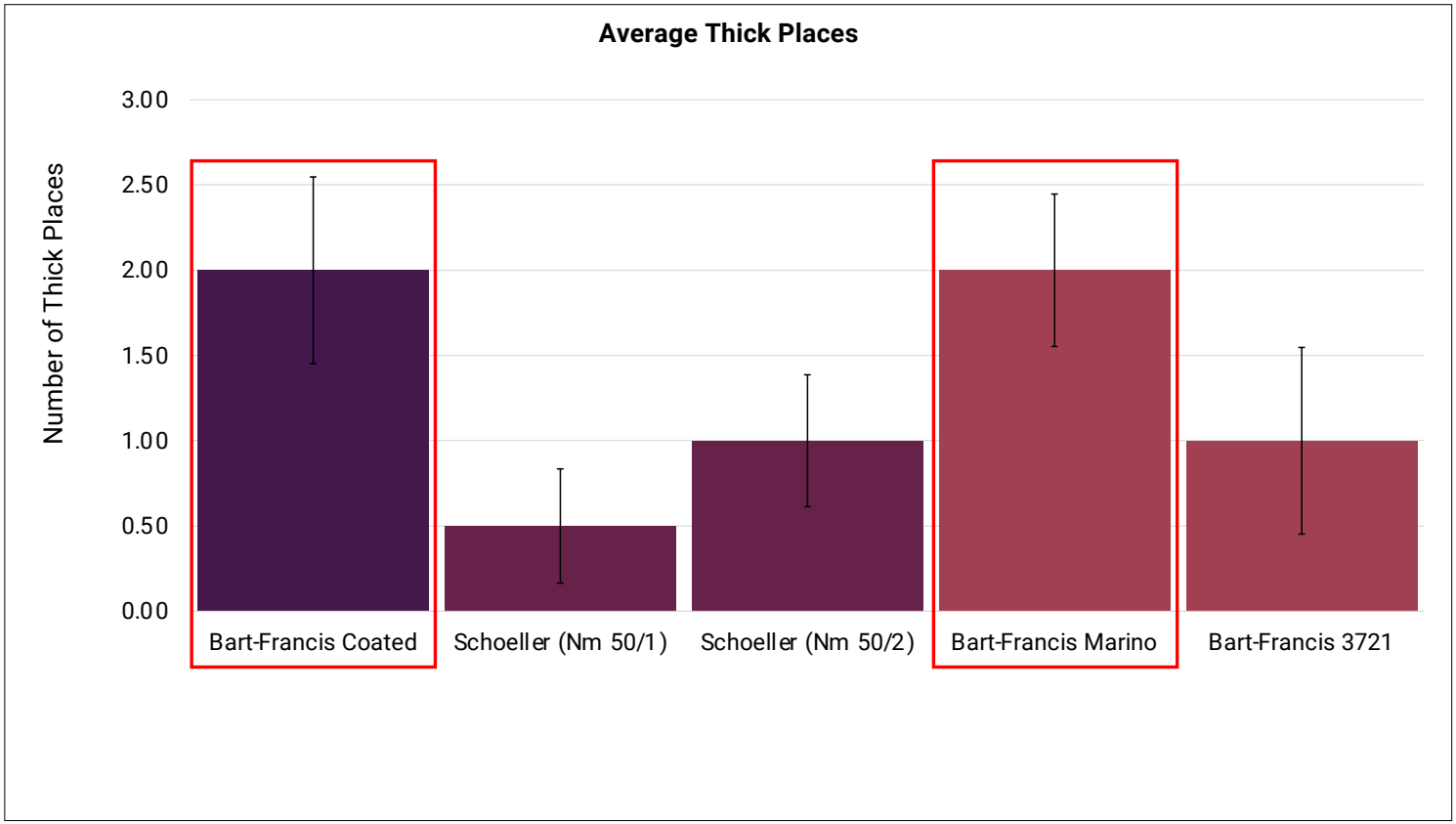
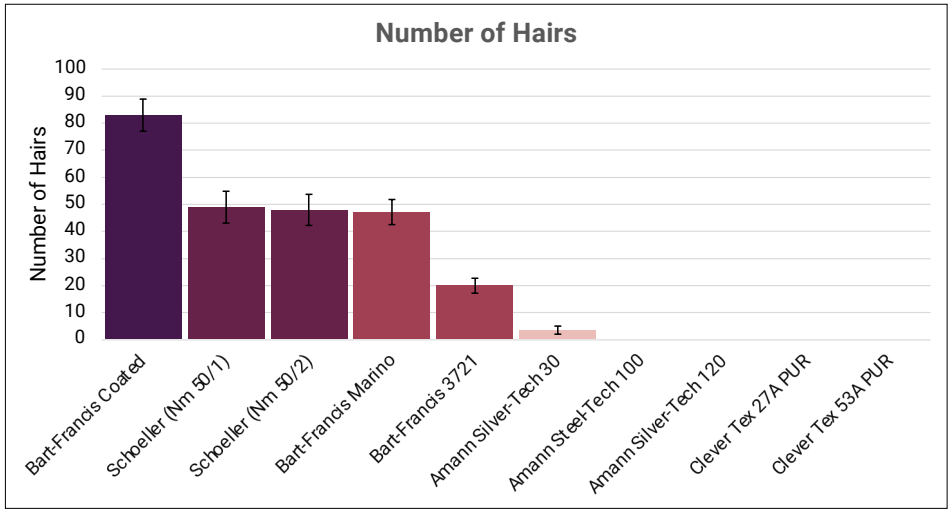


Number of Hairs



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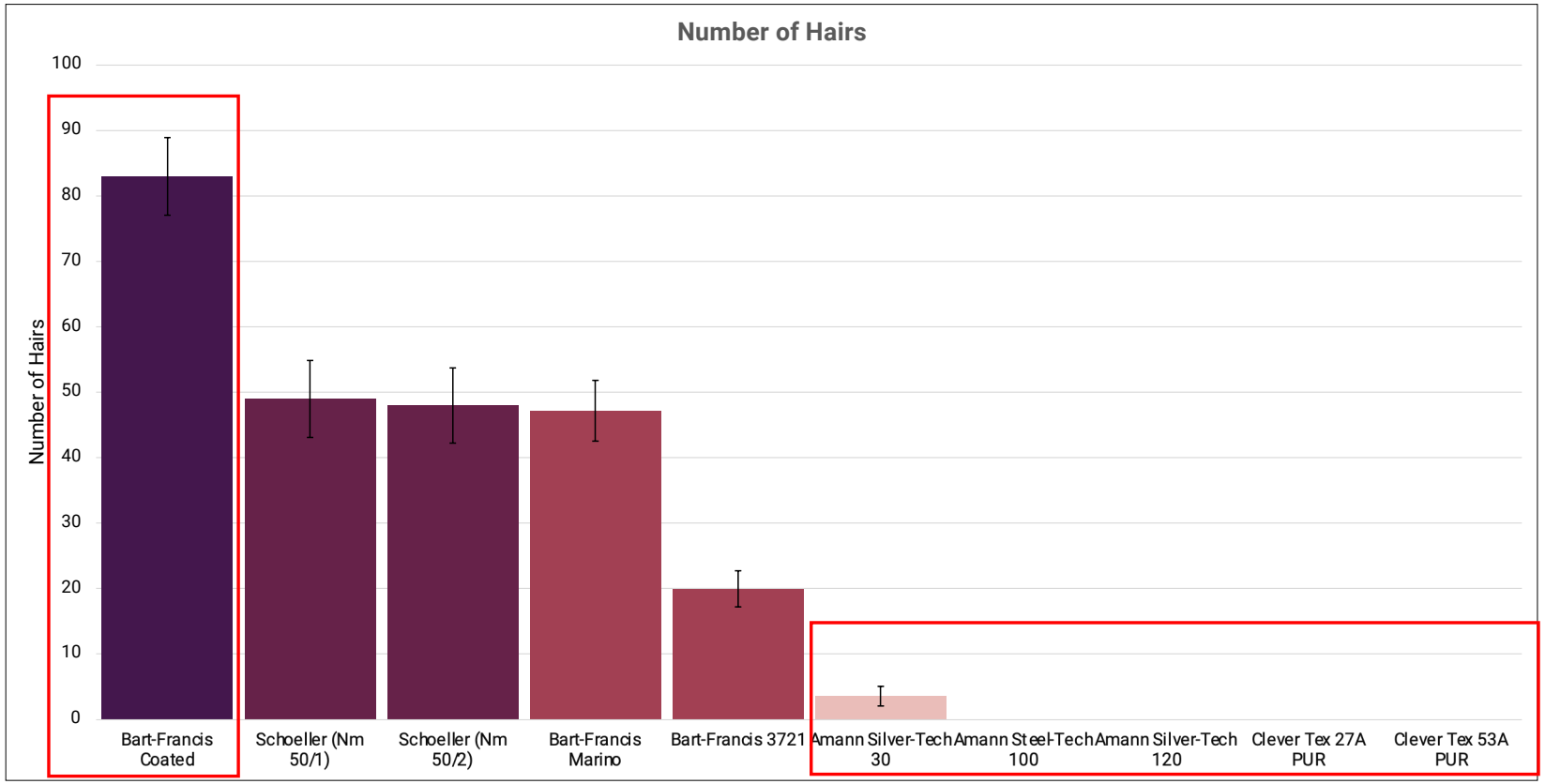
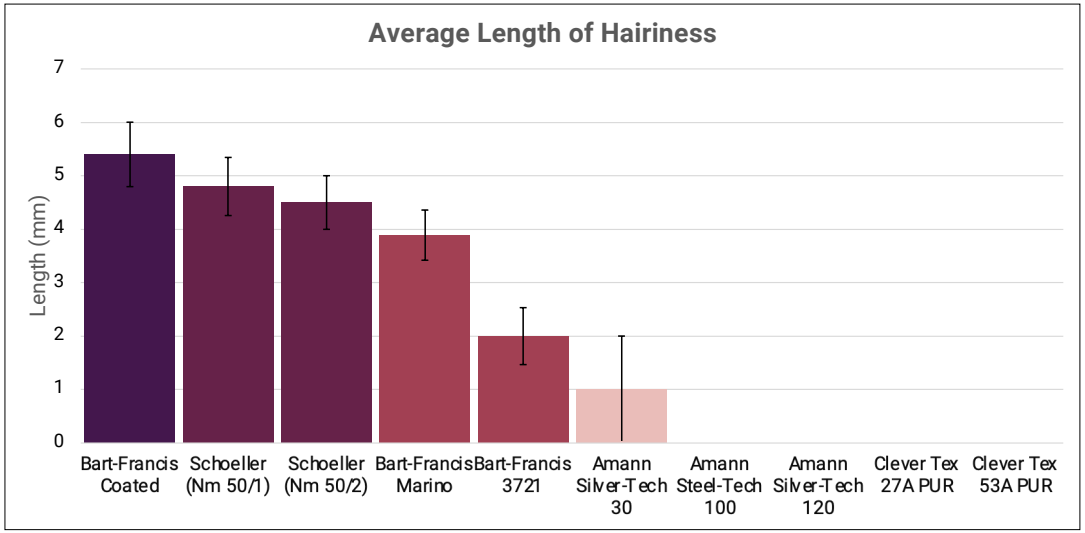
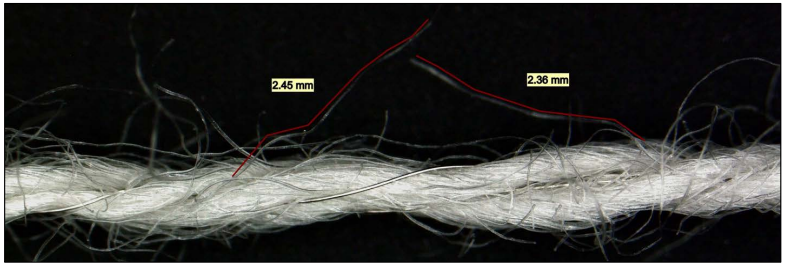
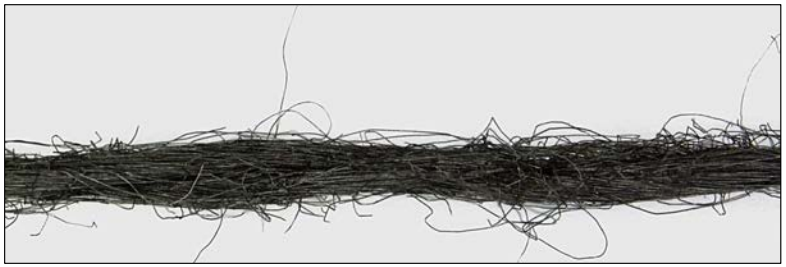


Average Length of Hairiness







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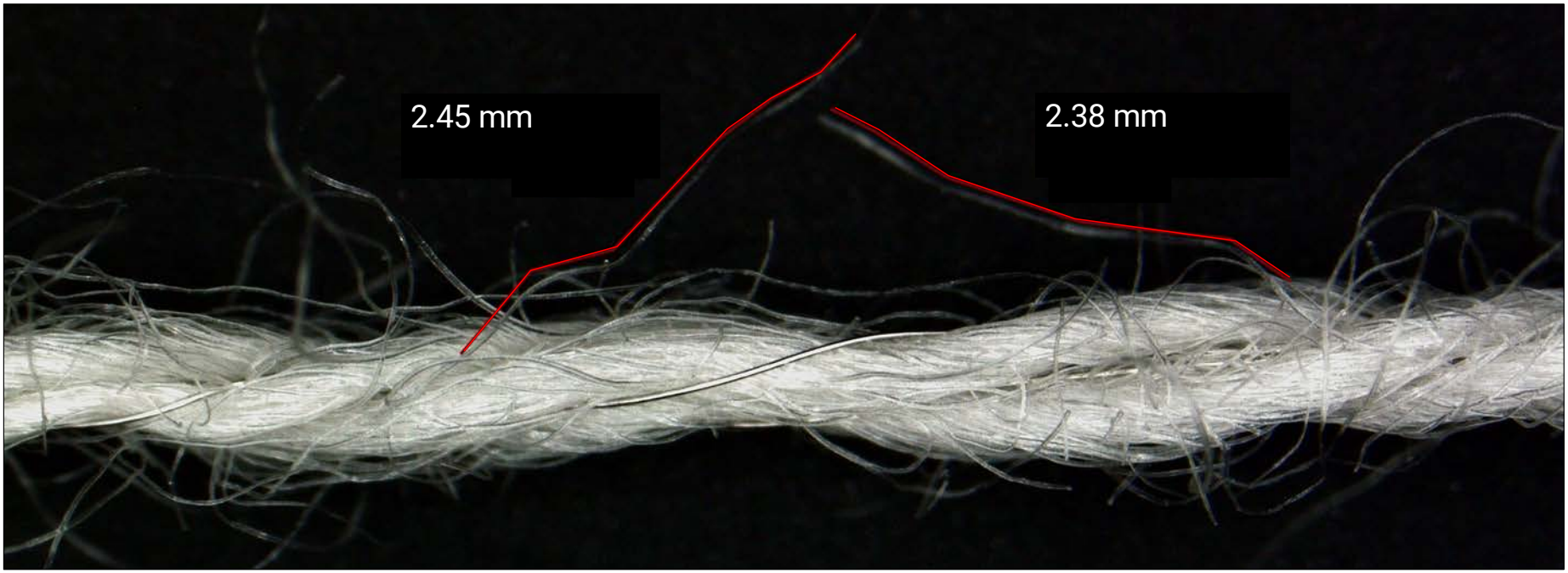

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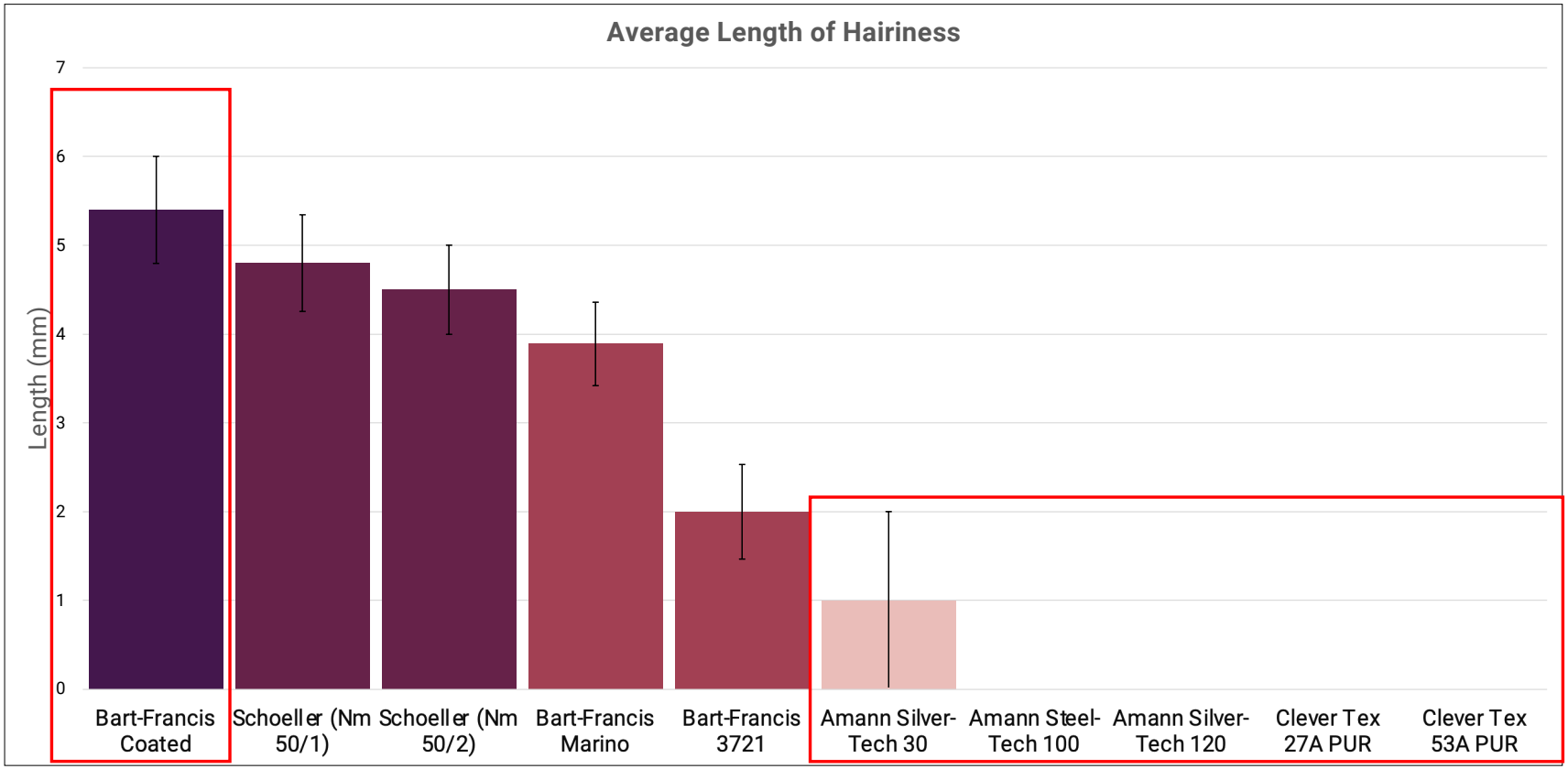
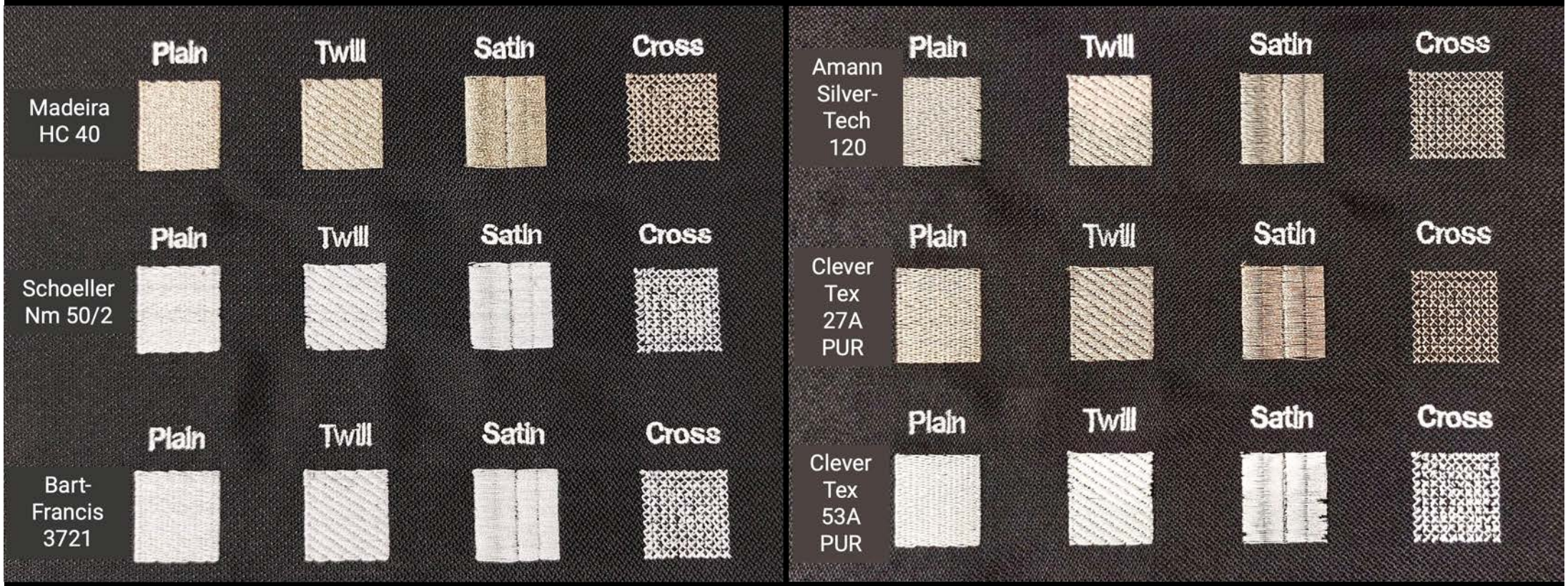


Embroidery

- Tajima Sai (MDP-S0801C)
- To check the processability
- Various textile structures and yarns

Embroidery Process



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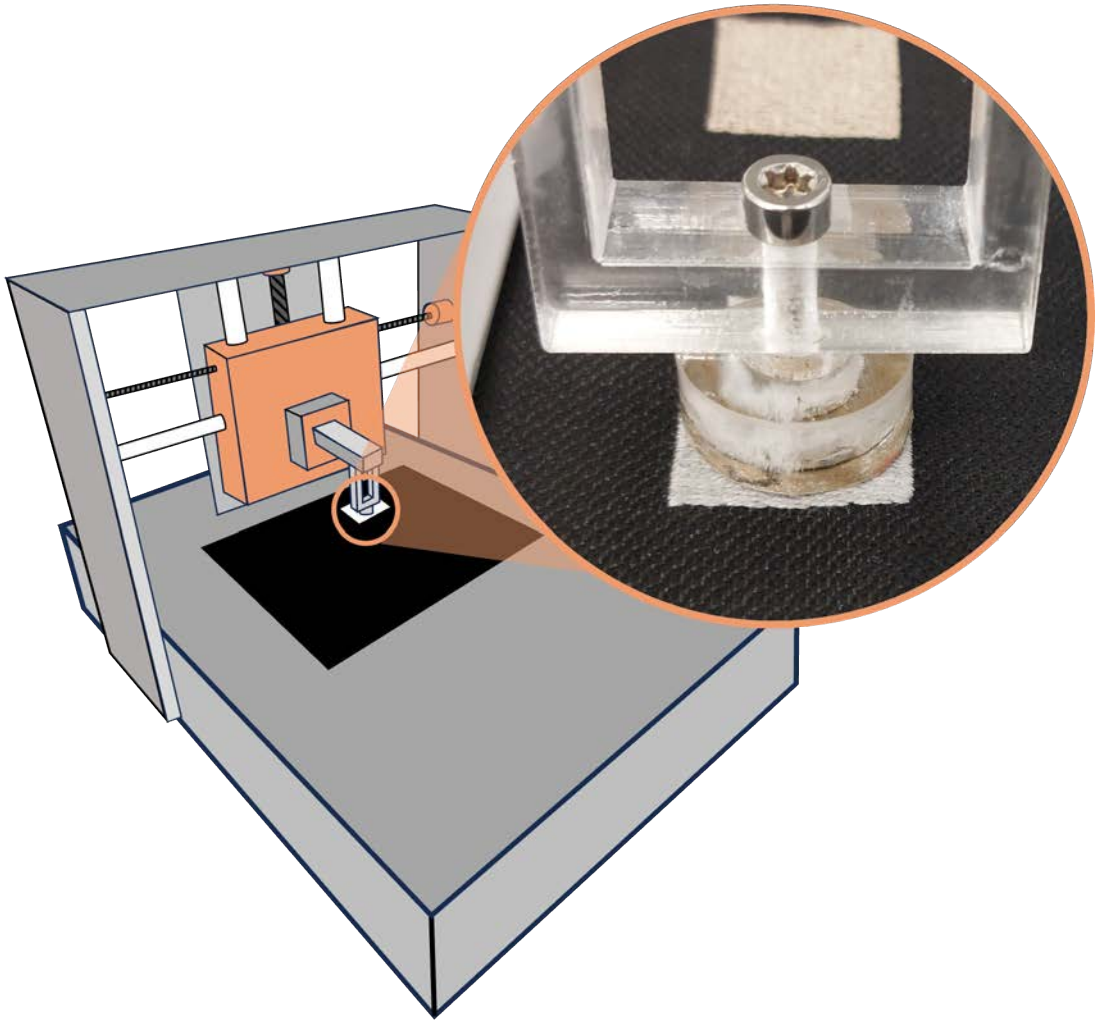
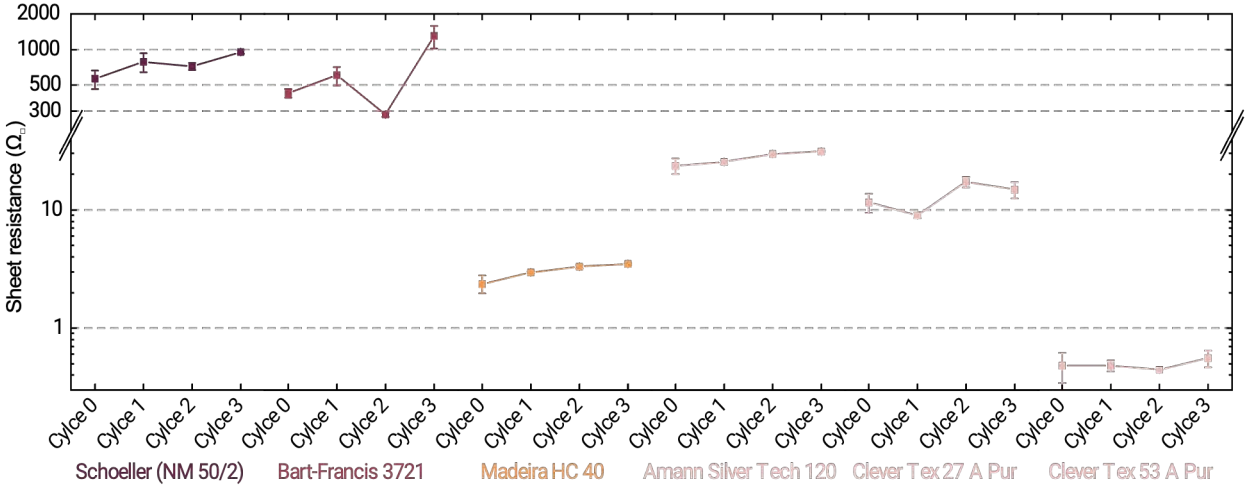
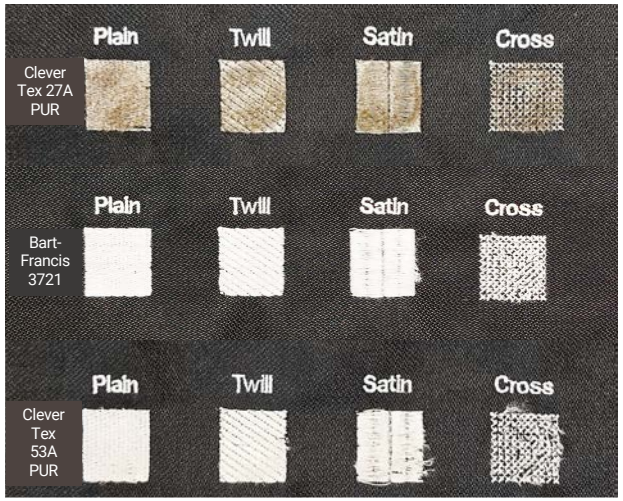
Abrasion tester

- A custom-built machine was used for the abrasion test
- With (2N→4N) force and (30/50/70) cycles



Abrasion Test





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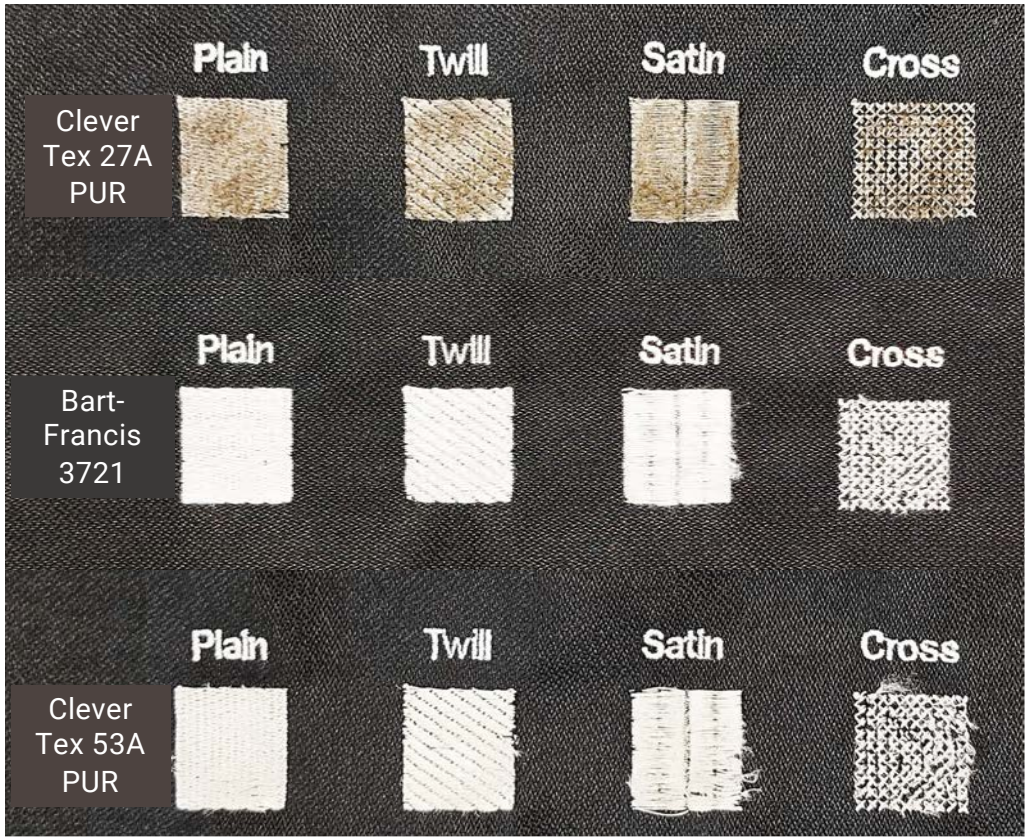

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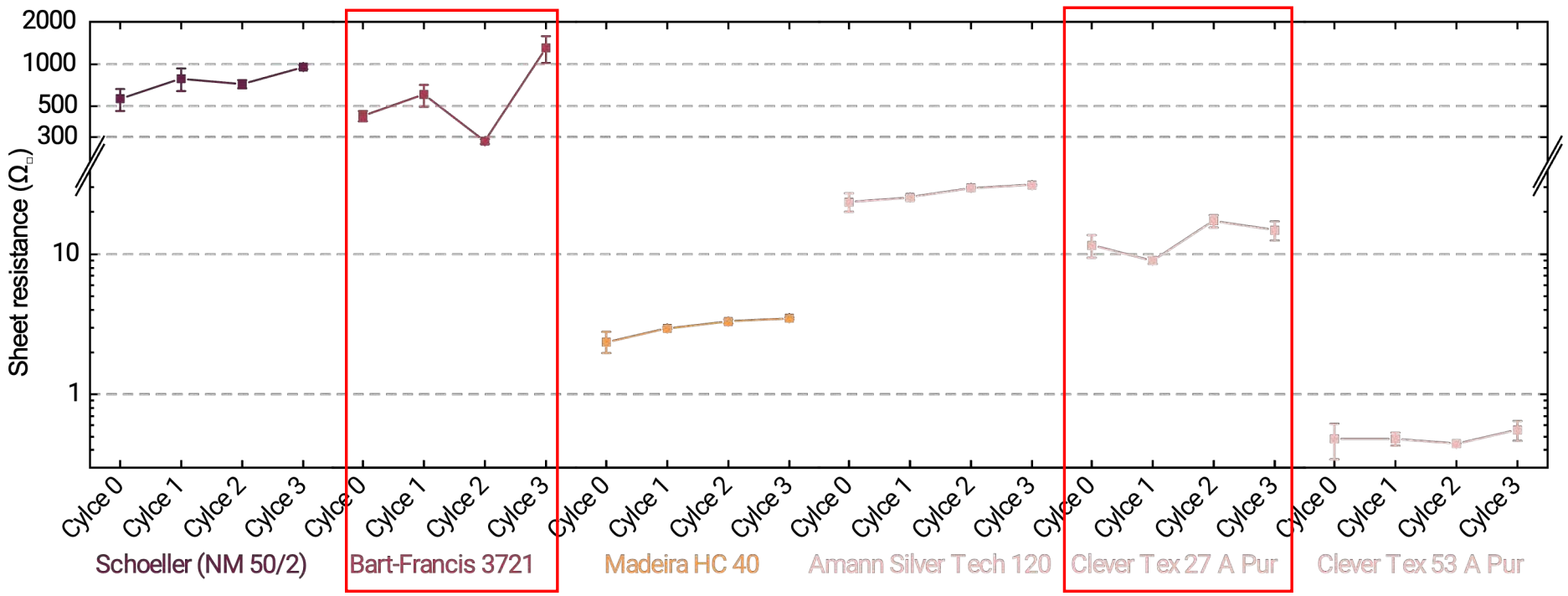
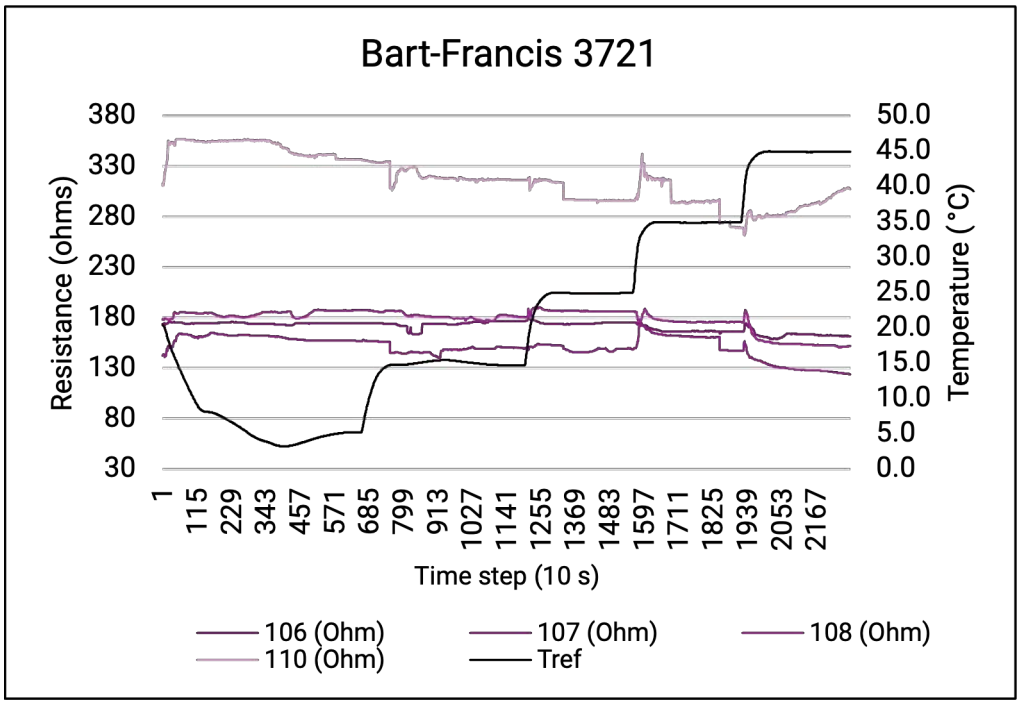


Heat Chamber Test



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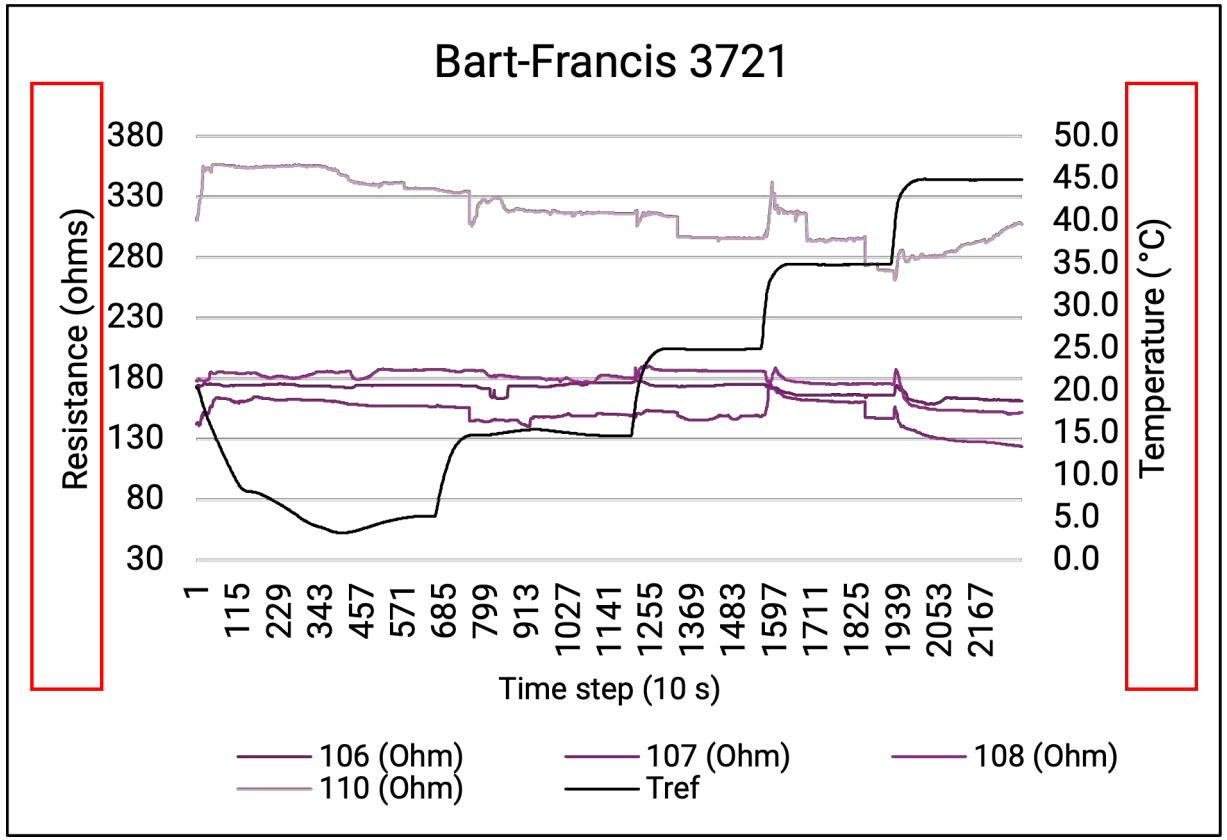
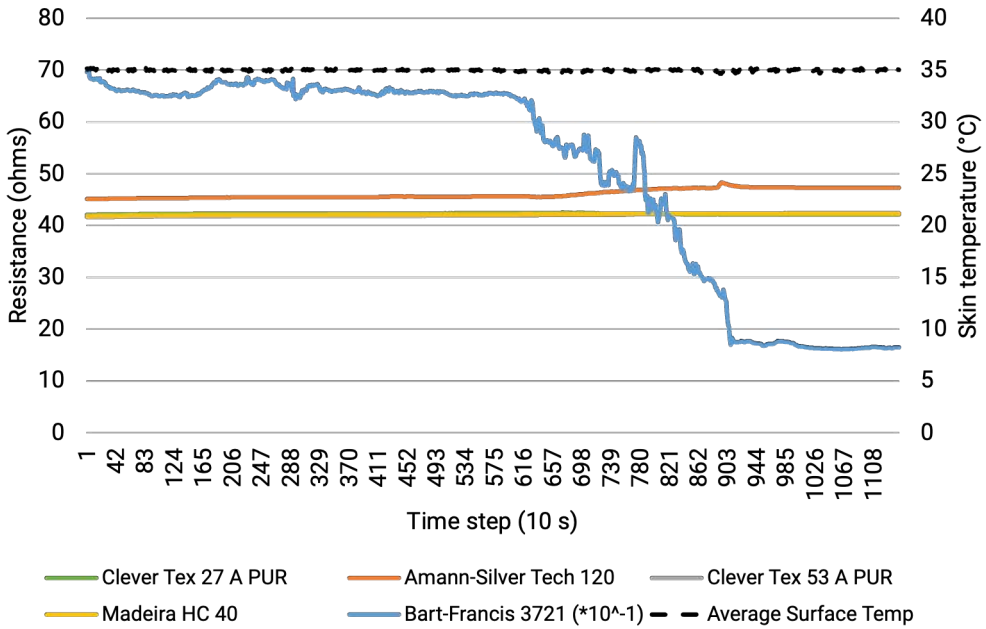
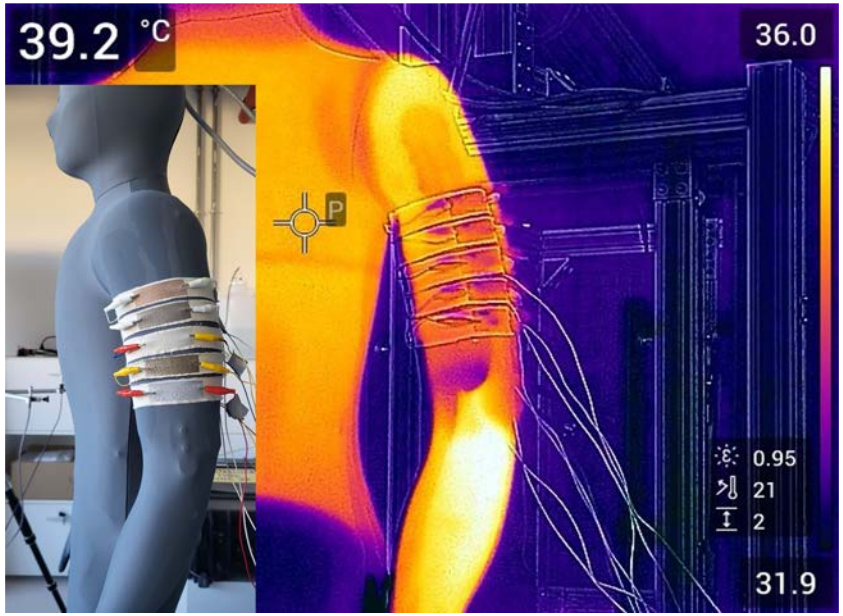


Wearability Test





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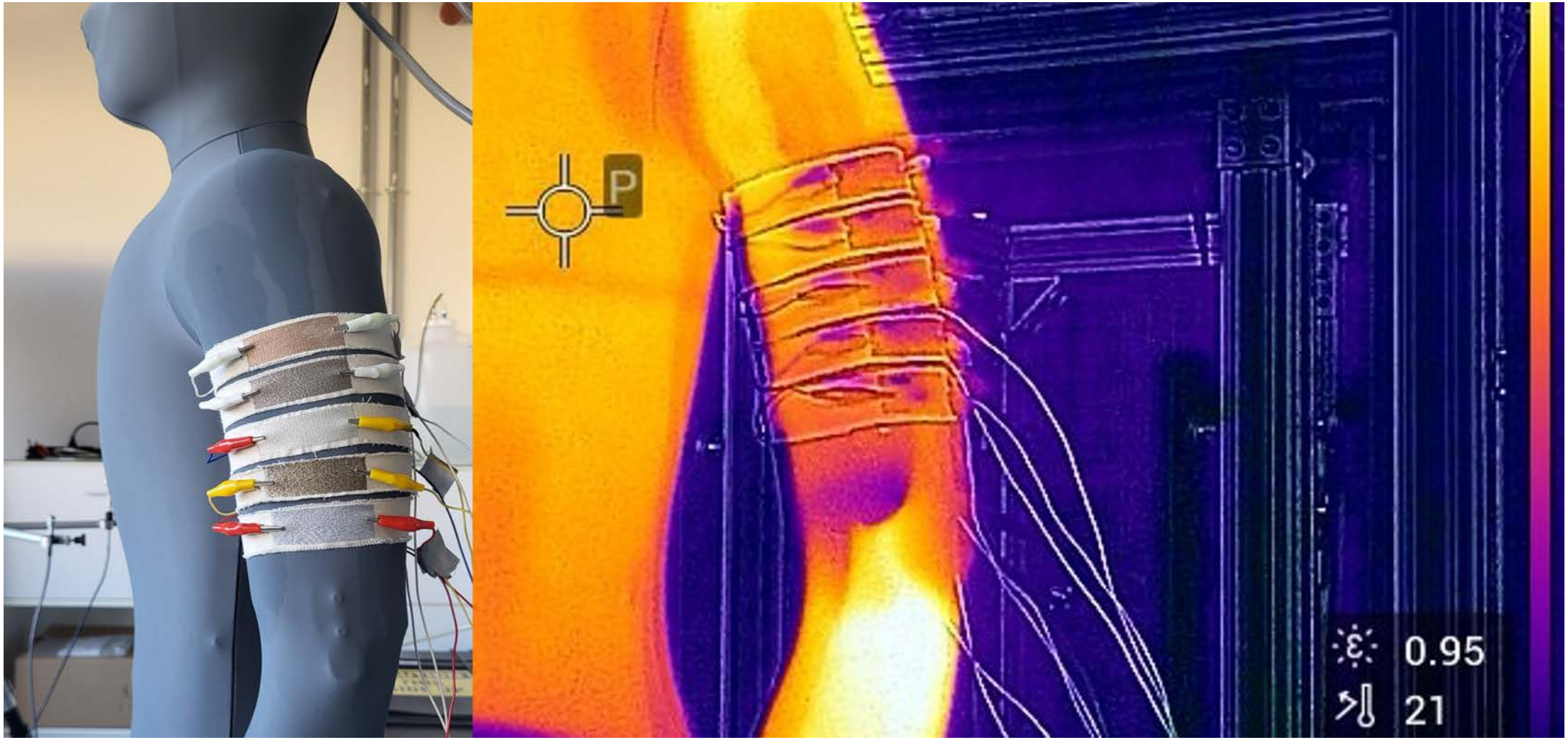

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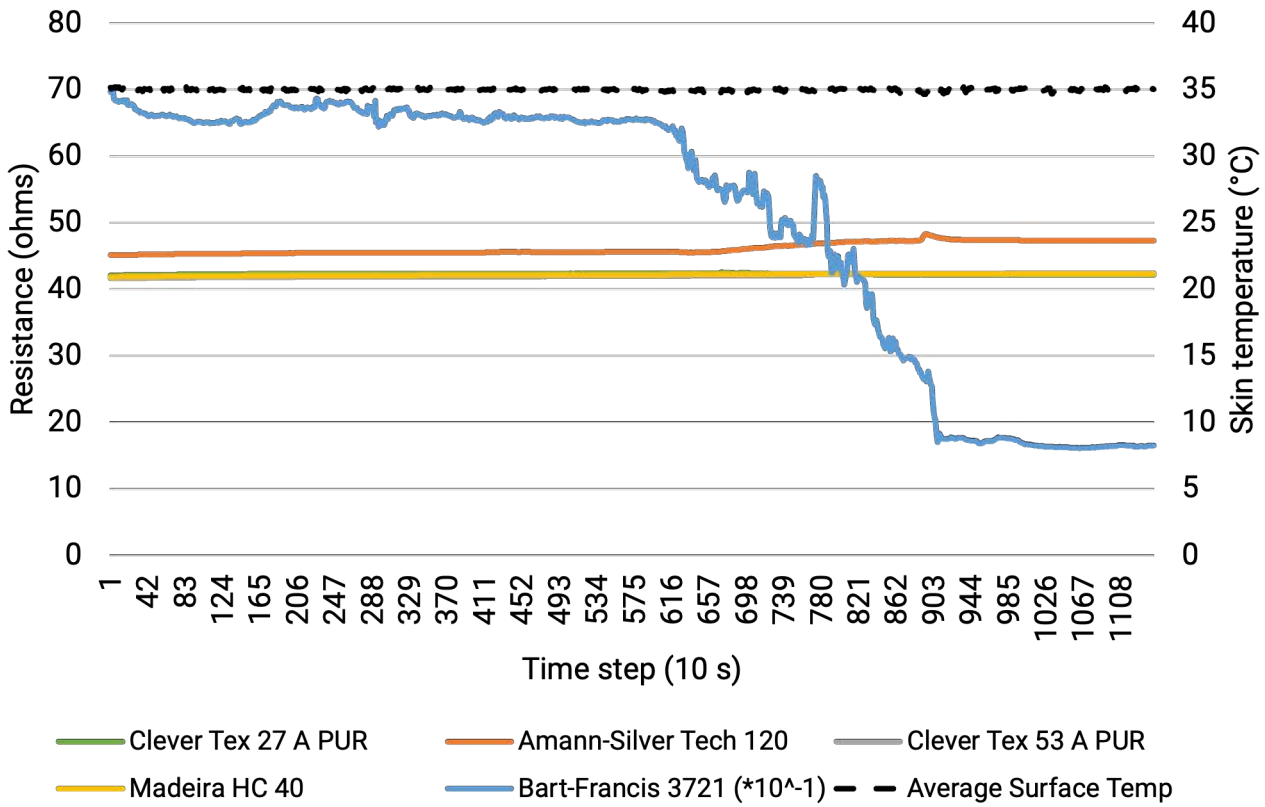

Conclusion & Future Work

- Madeira HC 40, and Clever Tex 53 A PUR
- Low-hairiness yarns showed best durability & electrical stability.
- Further validated in heating textile applications.

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Acknowledgment

This work was funded by Tratter Engineering and the European Union Next-Generation EU (Piano Nazionale di Ripresa e Resilienza, PNRR - DM 117/2023). This work was also supported by the Autonomous Province of Bozen-Bolzano-South Tyrol's European Regional Developmental Fund (ERDF) Program under Project EFRE/FESR 1011-SmartCover and under Project EFRE/FESR 1007 iPlay-ground.

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We are looking for an assistant professor starting in fall 2025

Contact us via

afahmed@unibz.it
michael.haller@unibz.it

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Problem Statement