THERMALLY ASSISTED PEELING AS A HIGH-QUALITY DISASSEMBLY PROCESS FOR THERMOPLASTIC TAPE WOUND COMPOSITES

Fraunhofer EMI

Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI

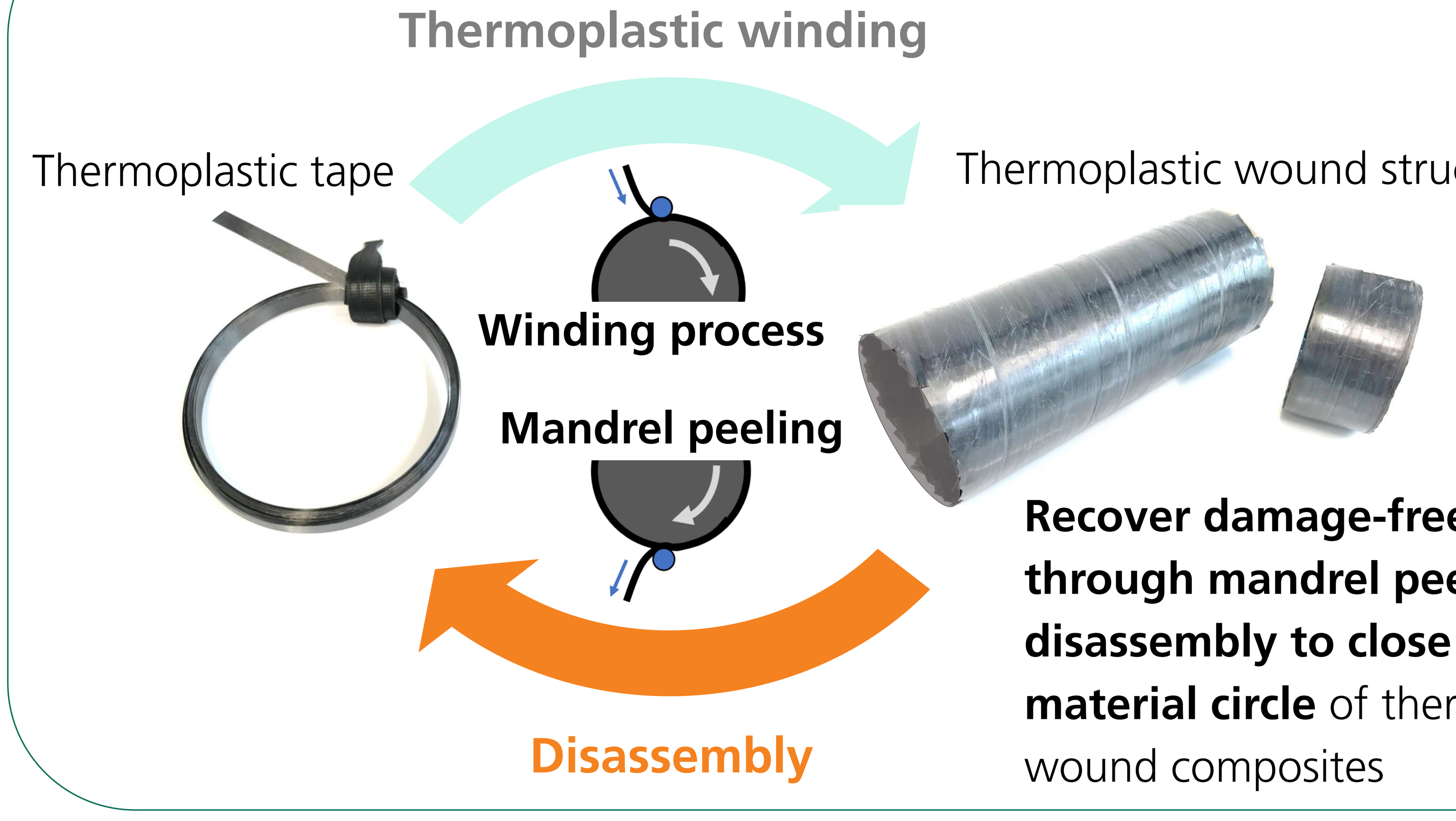
R. Grenier[1], M. Imbert[1], J. Hohe[2], F. Balle[1,3], and M. May[1]

[1] Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI, Freiburg, Germany

[2] Fraunhofer Institute for Mechanics of Materials, IWM, Freiburg, Germany

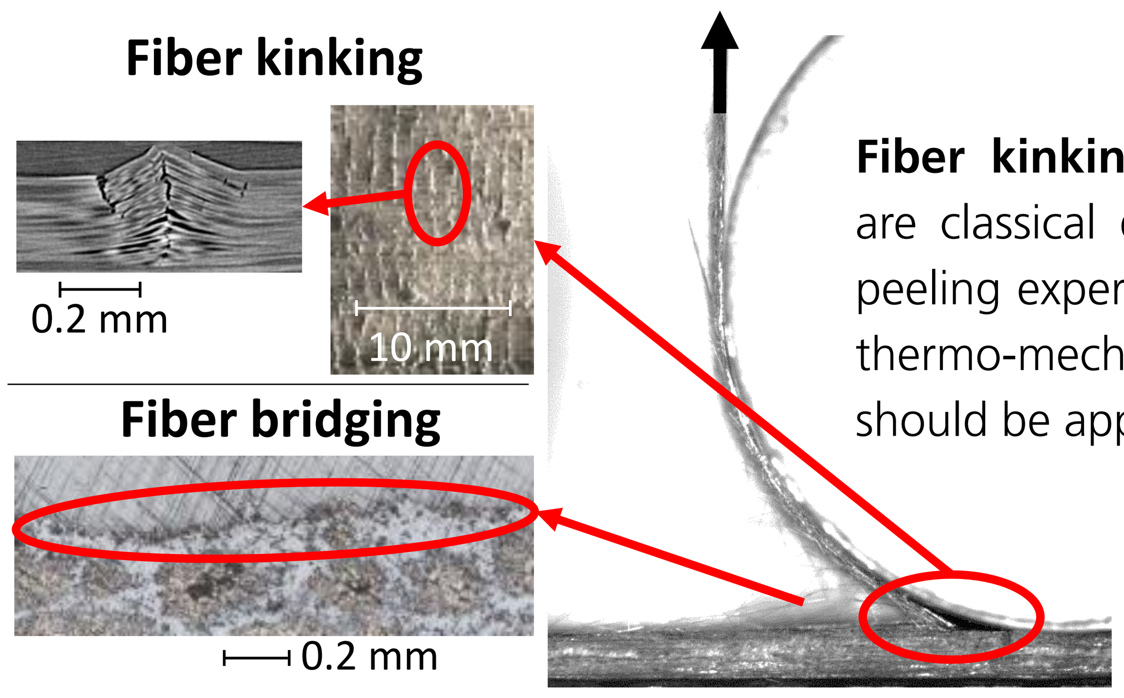
[3] University of Freiburg, Faculty of Engineering, Department of Sustainable Systems Engineering, INATECH, Walter-and-Ingeborg-Herrmann-Chair for Power Ultrasonics and Engineering of Functional Materials, Freiburg Germany

Goal



Recover damage-free tapes through mandrel peeling disassembly to close the material circle of thermo-plastic wound composites

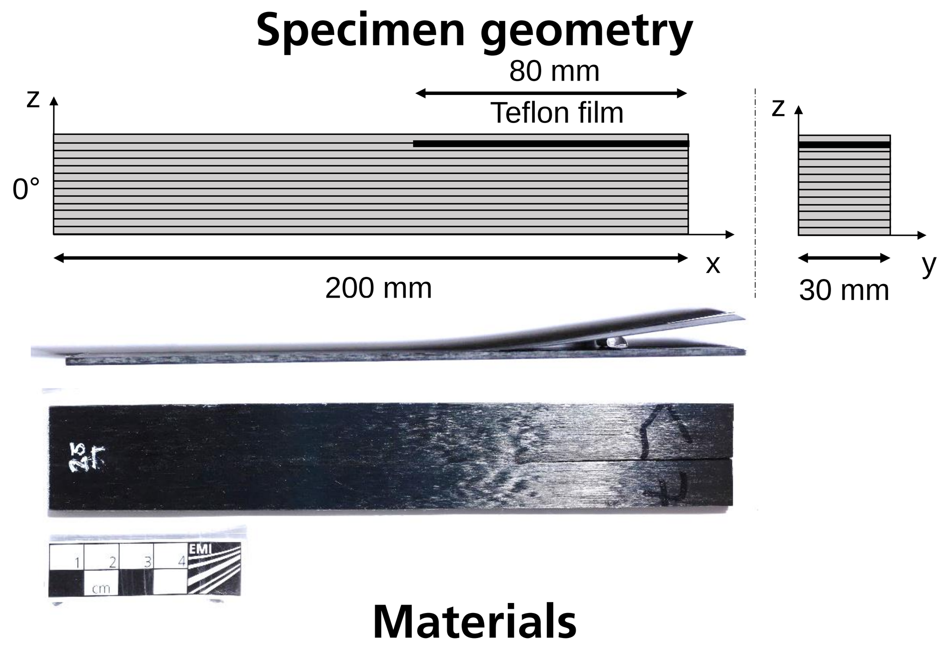
Challenges



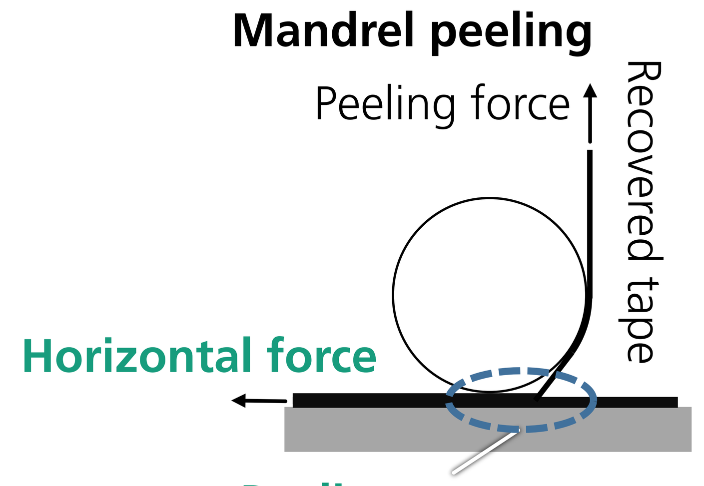
Fiber kinking and fiber bridging are classical damage mechanisms in peeling experiments. The appropriate thermo-mechanical disassembly loads should be applied to avoid them.

Materials and Methods

Specimen geometry



Mandrel peeling



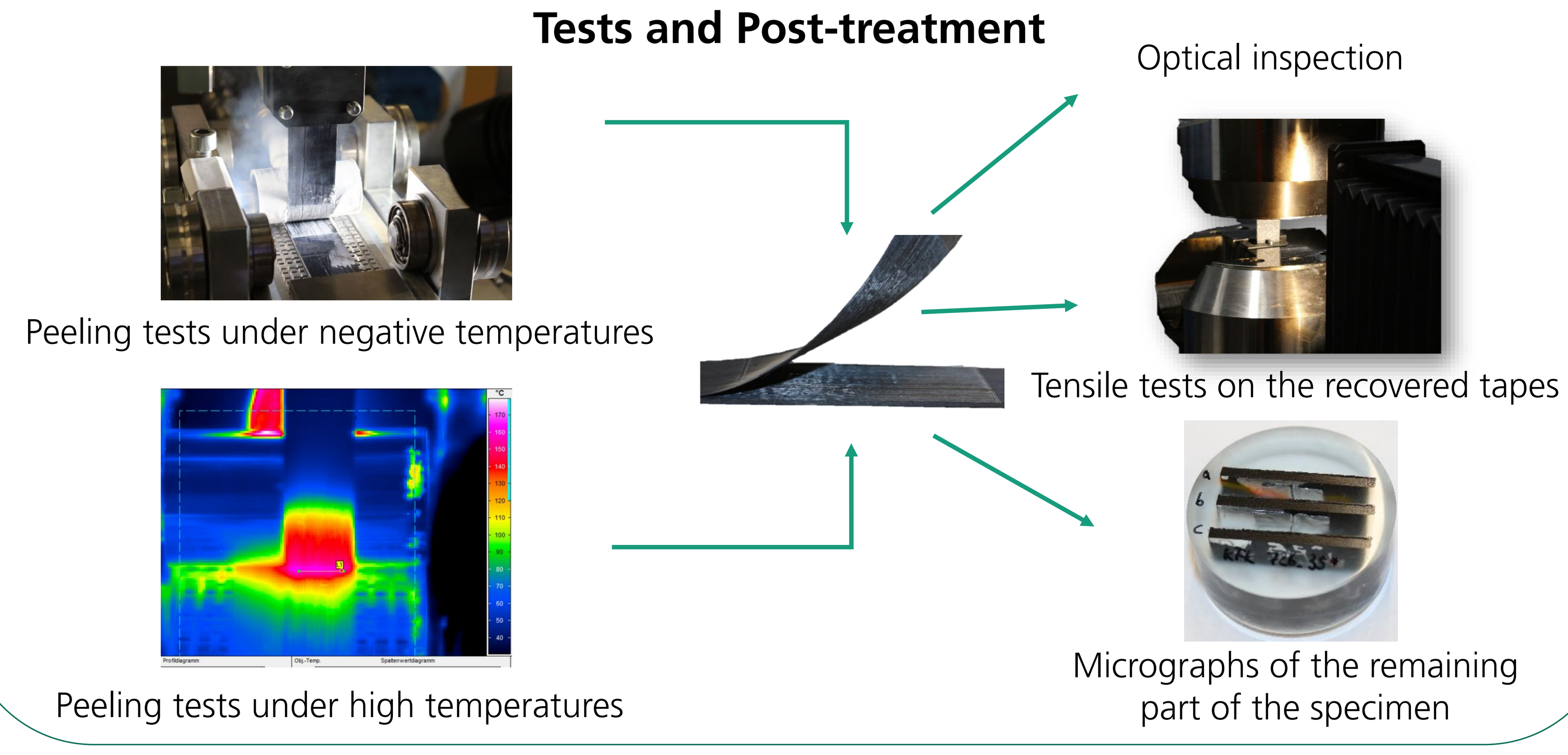
Materials

CF/PA6 (FVF: 42 %) Manufacturing: Double band press
CF/PPS (FVF: 53 %) Manufacturing: Automated Tape Placement

Process windows

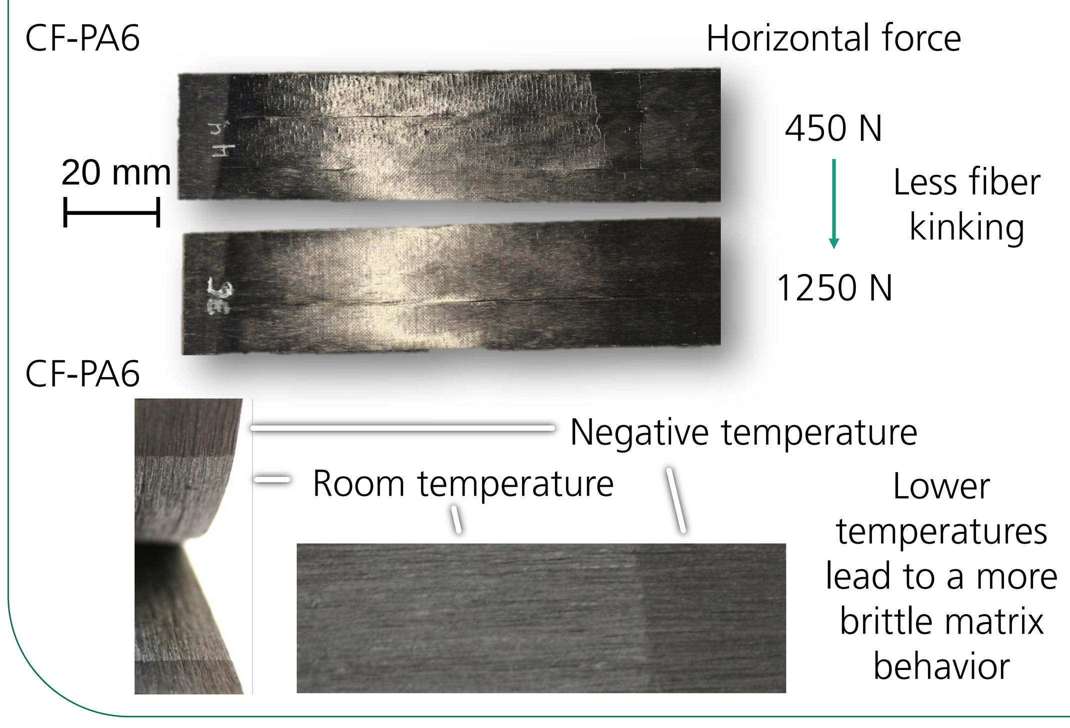
Horizontal force	450 N to 1250 N
Peeling temperature	-40 °C to 110 °C

Tests and Post-treatment

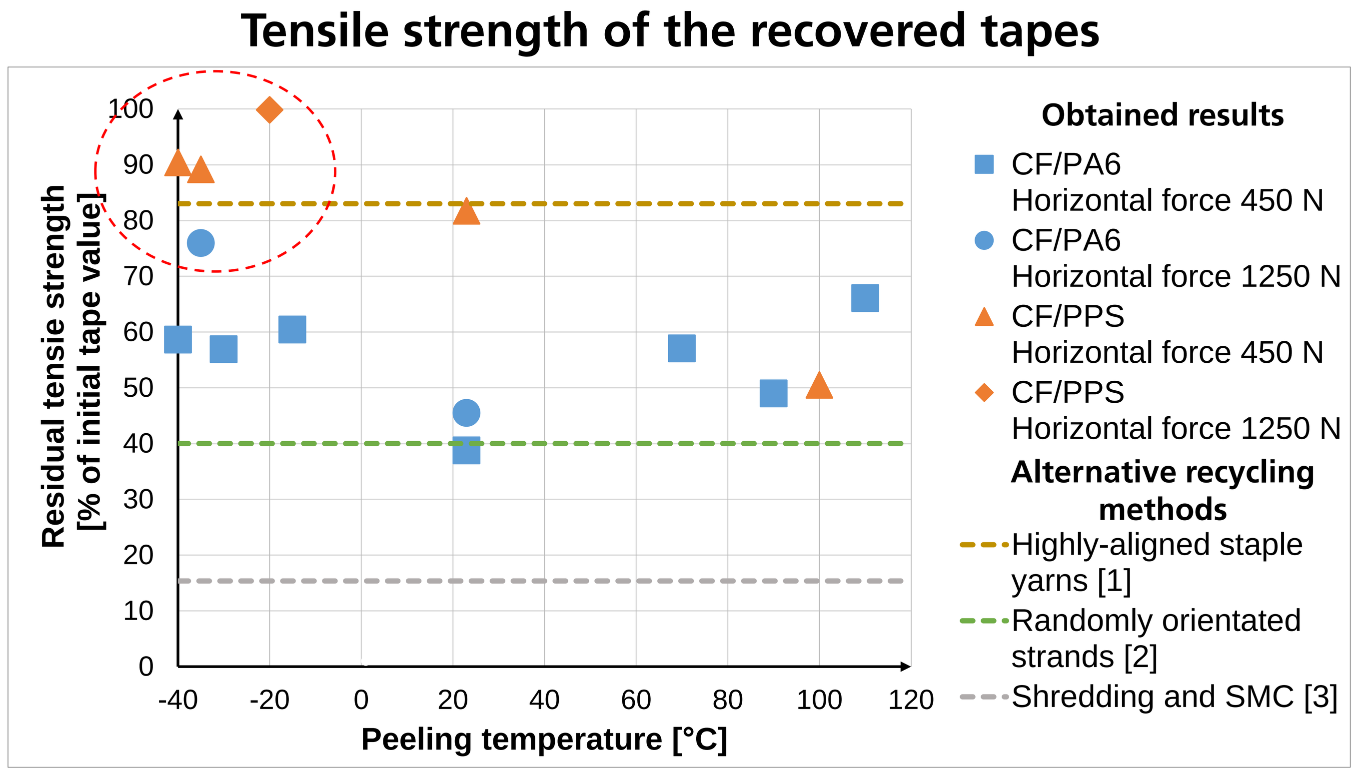


Results

Optical inspection

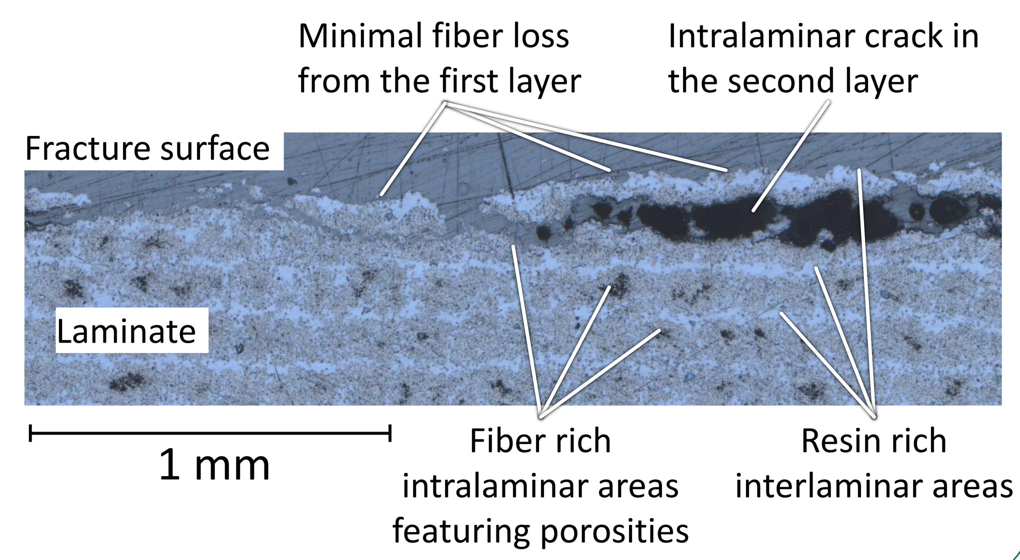


Tensile strength of the recovered tapes



Micrographs

Remaining part of a typical CF-PPS specimen
(Horizontal peeling force: 450 N Peeling temperature: 23 °C)



Observations

- **Tape tensile strength have been preserved** (75 % of the initial value for CF-PA6 and more than 85 % for CF-PPS) through peeling-based disassembly.
- **High horizontal forces are favorable to reduce fiber kinking** during mandrel peeling disassembly.
- **Negative temperatures** induce a more brittle matrix behavior and help to **preserve tape tensile properties.**
- **Peeling-based disassembly enables to recover, in one single process step, tapes with equivalent or better mechanical properties** than the ones obtained with laborious recycling processes based on staple fiber processing.
- **Crack propagation occurs more preferably in fiber rich (intralaminar) areas** than in matrix-rich (interlaminar) areas**.**

Conclusions

Thermally assisted peeling-based disassembly is a promising approach to recover preserved thermoplastic tapes from wound structures.
Ensuring process robustness requires to control crack propagation independently of the variability of the microstructure.

Contact

Dr. Mathieu Imbert
Group Manager Multi-Material Structures
Fraunhofer EMI
Tel. +49 761 2714-507
mathieu.imbert@emi.fraunhofer.de

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