From textile Waste to Fabric - Optimizing Textile Recycling and CO Footprint

Stephan Baz*†[1], Thomas Lehr[1], Jürgen Seibold[1], Markus Baumann[1], Iris Elser[1], Hagen Altmann[1], and Hans-Jürgen Bauder[1]

[1]German Institutes of Textile and Fiber Research Denkendorf – Germany

Abstract

Textile recycling is a key enabler for circular economy strategies. At the same time increasing material complexity and quality requirements pose significant challenges for closing the loop from textile waste to new fabrics. Beyond fiber recovery, a holistic assessment of process chains, including their environmental impact, is essential to ensure both ecological and economic viability.
This presentation presents the CYCLOTEXUM approach, which establishes a modular and industrially transferable pilot-scale process chain for textile-to-textile recycling. The concept integrates mechanical and physical recycling pathways, enabling the efficient processing of post-consumer and post-industrial textile waste. Focus of the presentation will be the mechanical recycling chains.

The entire process chain-from fiber opening, carding and spinning to yarn and fabric testing-is systematically evaluated with regard to fiber quality, spinnability, fabric producibility and resource efficiency. In addition, material flow analyses and cost accounting approaches are combined with CO footprint assessments to quantify environmental impacts along the value chain. This holistic perspective enables the identification of key levers for reducing emissions while maintaining high product quality.

The results demonstrate that the integrated approach significantly improves the availability and performance of high-value recycled yarns suitable for diverse applications. At the same time, optimized process configurations show considerable potential for lowering the carbon footprint compared to conventional production routes.
The presented work highlights how process integration and environmental assessment can accelerate the transition toward low-carbon, high-quality textile recycling systems and support the development of scalable, circular value creation models.

Keywords: Recycling, Mechanical, Cotton, CO2, MFCA

*Speaker
†Corresponding author: stephan.baz@ditf.de