Application Opportunities for Thermo-Mechanically Recycled Synthetic Textiles in Technical Textile Products

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Abstract

The growing accumulation of textile waste, together with increasing regulatory and sustainability pressures, highlights the need for scalable recycling solutions that retain material value. Thermo-mechanical recycling offers a promising route for converting synthetic post-industrial and post-consumer textile waste into new materials. However, broader industrial adoption depends on identifying applications that can accommodate the properties of recycled materials while meeting relevant performance requirements.

This study explores the application potential of thermo-mechanically recycled synthetic textiles in existing technical textile applications. A fabric containing 97% polyester and 3% elastane was processed from textile strips into granules using VTT's pilot-scale cylinder extruder MODIX, while also assessing scalability within a circular production context. MODIX is a unique extruder capable of processing uncompacted and fluffy streams of thermoplastic materials. The granules were produced into monofilaments using a melt spinning technology.

The monofilaments are evaluated for use in technical textile applications that can utilise relatively coarse recycled filaments and structures derived from them. Potential application pathways include industrial-scale webbing production and 3D printing of textile surfaces. Material-property requirements, processing opportunities, and implementation challenges are assessed during the processes, while the recycled material is characterised in terms of uniformity and mechanical properties.

The findings demonstrate promising opportunities for integrating thermo-mechanically recycled synthetic textiles into selected technical textile applications. The study highlights the importance of aligning recycled-material characteristics with application-specific performance requirements and shows how application-driven assessment can support the industrial adoption of recycled textile materials. The results contribute to the development of circular textile value chains by enabling the transformation of synthetic textile waste into value-added technical textile products.

Keywords: Thermomechanical recycling, circular textiles, polyester blends, cylindrical extrusion, melt processing, technical textile manufacturing, textile, to, textile recycling

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