Adhesive-Free and Recyclable Carpet by Combined Tufting and Needle-Punch Technology (TuNa)

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Abstract

Tufted textile floor coverings typically require a finishing step to integrate piles into the primary backing. For this purpose, chalk-filled SBR latex is usually used as an adhesive, which significantly impairs recyclability. In light of upcoming legal requirements and growing consumer demand for chemical-free products, alternative solutions are needed.
The TuNa project is developing an innovative, adhesive-free manufacturing process for tufted carpets. The focus is on the mechanical bonding of the pile layer with a nonwoven backing by targeted needling. This is intended to fulfill three key functions: stable bonding of the tufting layer and the backing, fixing the pile loops in the primary backing and, if necessary, consolidating the backing material to ensure the required mechanical properties of the product. Systematic investigations analyze the process parameters of tufting, nonwoven production, and needle punch to achieve the bonding quality and properties of the finished textile floor covering.

At the same time, a recycling concept is being developed that enables the separation of the nonwoven backing from the tufted material. Two recovery paths are being compared: mechanical recycling of the separated backing for fiber recovery, using the needling bond as a separation layer, and recycling of the entire carpet composite without pre-separation. The goal is to evaluate recyclability and fiber quality and identify the more economically and ecologically viable approach.

This is done as part of an ecological and economic assessment compared to conventional floor coverings. In Germany, around 170,000 tons of carpet waste are generated annually, most of which are currently only thermally recycled. The new process could significantly reduce this volume and substantially increase the circular potential of tufted textile floor coverings.
The IGF project 23673N of the Forschungskuratorium Textil e.V. research association, is funded by the Federal Ministry for Economic Affairs and Energy as part of the programme for the promotion of industrial collaborative research and development (IGF), following a resolution of the German Bundestag.

Keywords: Textile Floorings, Tufting, Needlepunch, Recycling, Circularity, Sustainability

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