

**Project title:** Production of ropes from recycled material by reactive extrusion

**Partner:** EDELRID GmbH & Co. KG, Isny im Allgäu  
Hoffmann+Voss GmbH, Viersen

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**Univ.-Prof.**  
**Prof. h.c. (Moscow State Univ.)**  
**Dr.-Ing. Dipl.-Wirt. Ing.**  
**Thomas Gries**  
Head of institute

**Lukasz Debicki**  
Researcher

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### Mission Statement

Climbing ropes are currently manufactured from new polyamide (PA), as the available PA regranulate does not meet the high requirements for technical yarns. The companies EDELRID and Hoffmann+Voss are working together on an interdisciplinary basis with the Institute for Textile Technology at RWTH Aachen University in the publicly funded ZIM project "ReaktivSeil" (ZF 4018734CJ6) to develop and manufacture a climbing rope made of recycled PA using reactive extrusion.

Climbing ropes consist of two sections: a core of parallel twisted filament yarn and a braided sheath. The core is the supporting element of the rope and must have a high strength (approx. 70 cN/tex) as well as a relatively high elongation (approx. 20 %). The elongation is necessary to dampen the energy in a fall. The jacket serves to protect the core from mechanical stress caused by friction or water ingress. In order to achieve the required tensile strength, the material must have polymer chains as long as possible. During the recycling process and the use phase of the rope, the polymer chains are damaged or the molecular weight of the material decreases. For this reason, no polymer waste has been used for new climbing ropes.

### Approach and Solution:

The innovation within the project "ReaktivSeil" is the development of a process for the production of industrial yarn from polyamide waste and the production of a climbing rope from recycled material. Production waste should no longer be disposed of, but shredded and reactivated by adding a chain extender or a vacuum treatment during re-granulate production (cf. Figure 1). This converts the production waste into a new granulate and can be used again for high-quality climbing ropes without any loss of properties.

It is planned to specifically adapt the reactive extrusion in order to condense the PA. This connects the polymer chains and increases the molecular weight. High-strength filaments are then produced from this almost new material. The challenge in this process is to set a defined molecular weight distribution which is necessary for the production of industrial yarn. Furthermore, it must be ensured that impurities in the material do not disturb or negatively influence the extrusion or further processing during melt spinning into filament yarn.

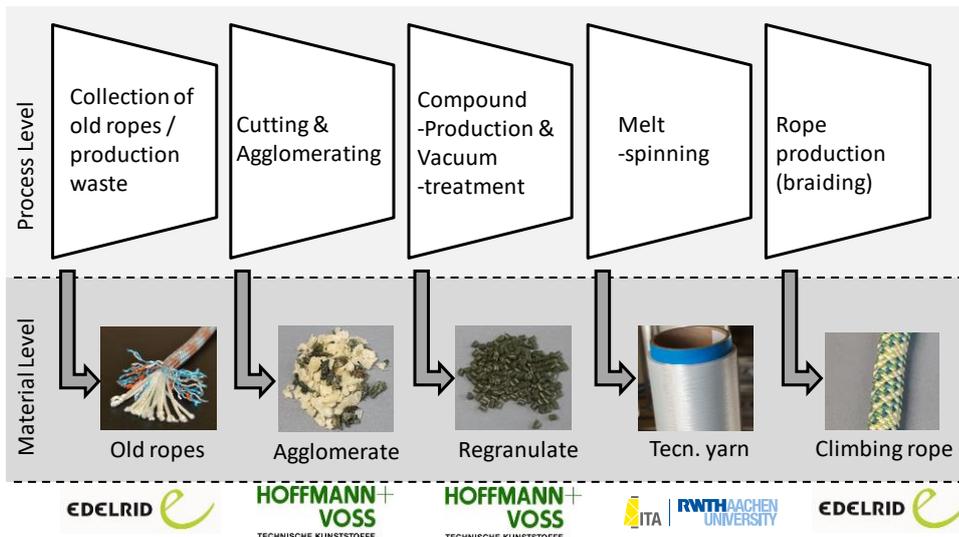


Figure 1: Procedure for manufacturing a climbing rope from production waste

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### Contact

Dipl.-Ing. Lukasz Debicki  
Researcher Chemical Fiber Technology

Institut für Textiltechnik of RWTH Aachen University  
Otto-Blumenthal-Str. 1  
52074 Aachen  
Tel.: +49/(0)241/80 234 75  
Fax: +49/(0)241 80 22422  
Lukasz.Debicki@ita.rwth-aachen.de  
www.ita.rwth-aachen.de