

Project title: ZIM Wash
Partner: Fourné Maschinenbau GmbH, Alfter-Impekoven
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Mission Statement

With the prohibition of environmentally hazardous solvents currently being discussed more and more in the EU and the reduction of limit values for hazardous substances in products, there is a need for improved systems that make it possible to further reduce the residual solvent content (RSC) in fibers. This plays an important role in the production of polyacrylonitrile (PAN) fibers. According to the Technical Rules for Hazardous Substances (TRGS) 401 "Risk of skin contact", the upper limit value of the solvent dimethylformamide (DMF) is 10 mg/kg [TRGS08]. The purification of the fibers required for this in the spinning process is very complex and increasingly reduces the economic efficiency of the spinning processes. Thus, there is a need for innovative plant technologies that can achieve lower solvent contents in the fiber by means of more efficient washing processes and at the same time require less effort than before.

Solution

The aim of this project is to develop an innovative washing system to increase the efficiency of the washing process and the reduction of the RSC in the production of wet-spun man-made fibers. At Institut für Textiltechnik of RWTH Aachen University (ITA), various influencing factors and parameters for the targeted opening of multifilament yarns with the aid of turbulence in liquid media have already been determined and developed. Based on these findings, design concepts are developed with the aid of flow simulations and converted into a prototype. The prototype will be integrated into a wet spinning plant at the ITA and validated with regard to increased efficiency and possible fiber damage. This project is carried out in cooperation with Fourné Maschinenbau GmbH and the Institute for Textile Technology of RWTH Aachen University.

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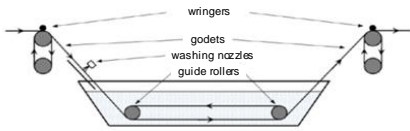
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State of the art

- Usage of conventional washing bath to manufacture wet-spun fibers



Deficit

- Multifilament fiber exists as compact fiber bundle -> inhibition of:
 - diffusion (solvent)
 - convection/evacuation of solvent
- Reduction of residual solvent content only by usage of additional baths

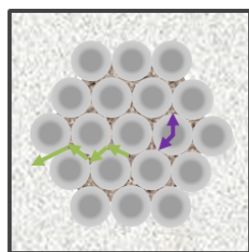


Aim

Development of a washing system for wet spinning plants to reduce residual solvent content below 10 ppm and the washing mass flow of 27%



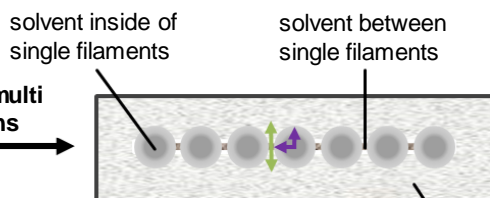
Approach



cross-section of compacted multi filament yarn

opening of multi filament yarns

- diffusion
- convection



cross-section of ideally opened multi filament yarn

washing solution

1 Development of a washing method based on the shown principle (opening of bundle)

2 Validation of unit in spinning process



Economic and ecological relevance

- Reduction of manufacturing costs of wet-spun fibers by 5% (eg PAN precursor) by reducing the washing water mass flow by 27% [Wil14]
- Reproduction of energy costs during the treatment of waste water
- Reduction of process waste water

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