

# Correlation of surface topology to the properties of yarns

## Korrelation von Oberflächentopologie auf die Eigenschaft von Garnen

### Graduate



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**Definition of Task:** This bachelor's thesis focuses on the production and analysis of technical yarns, with a particular emphasis on the surface texture (topology) of ceramic nozzle plates. The study investigates how this topology influences the properties of the yarns. Optical and tactile measurement techniques will be used to detect and classify changes in the nozzle surface. The aim is to identify correlations between changes in the nozzle surface and yarn quality in order to recognize optimization potentials in the manufacturing process, thereby improving product quality and process stability.

**Approach:** The procedure includes conducting roughness measurements on ceramic nozzle plates, which were carried out on-site at Heberlein. Fifteen plates with different roughness levels were manufactured and prepared for optical and tactile measurements. The surface measurements began with the calibration of the devices using surface standards and continued with detailed measurements using tactile and optical instruments. Textile processing runs with different settings were conducted in a textile laboratory. The collected data were systematically recorded in Excel tables and analyzed using Matlab to examine the roughness and its impact on yarn quality.

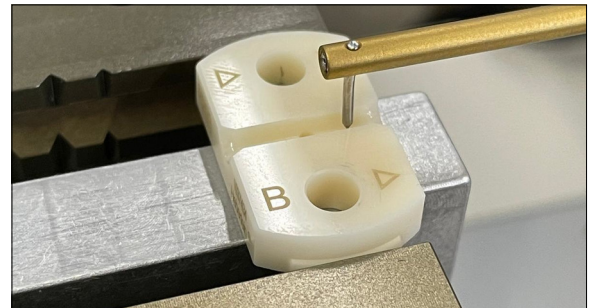
**Result:** The results of the calculations show that the roughness values generally have a higher impact on tensile strength and elongation at break than on the number and stability of the entanglement points. The  $R_p$  and  $R_{pk}$  values emerged as having the highest correlation. Both values show a tendency for high correlation with tensile strength and elongation at break. The smaller the  $R_p$  and  $R_{pk}$  values, the more energy-efficiently the entanglement points can be incorporated into the yarn. However, the correlations

also depend on the setting parameters of the textile tests and can vary significantly. This makes it difficult to clearly predict the yarn properties.

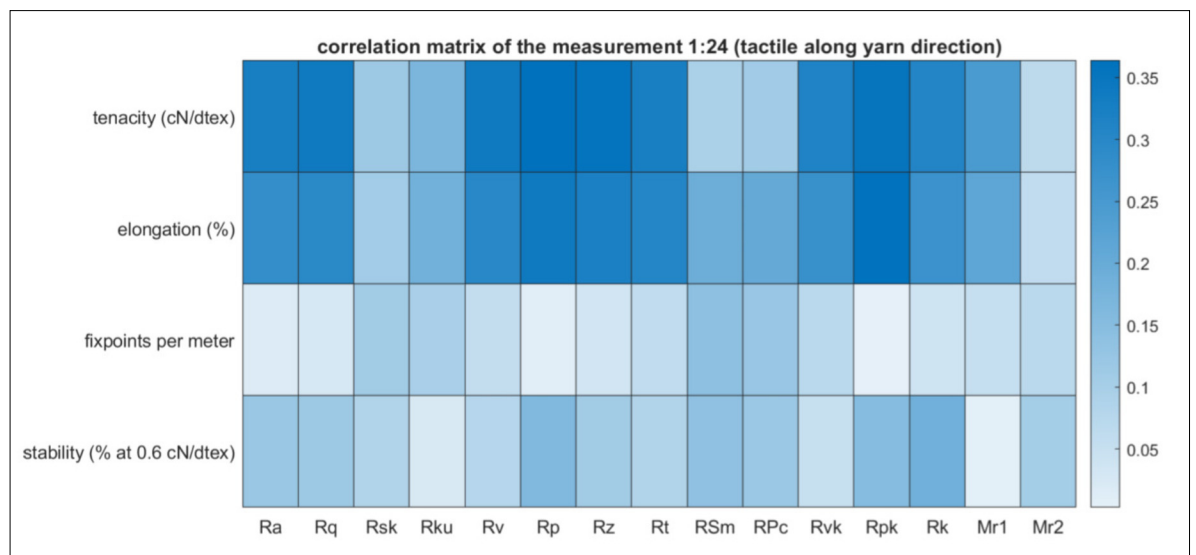
**Final product: "SlideJet-FT15-2" from Heberlein with an integrated nozzleplate**  
[www.heberlein.com](http://www.heberlein.com)



**Tactile measurement: Along the direction of the yarn flow in the channel of a nozzleplate**  
 Own presentation



**Evaluation of the correlation matrix in the Matlab program (the darker the field, the higher the correlation)**  
 Own presentation



**Advisor**  
 Prof. Dr. Michael Marxer

**Co-Examiner**  
 Prof. Dr. Hans Fritz

**Subject Area**  
 Mechanical Engineering