TECHNICKÁ UNIVERZITA V LIBERCI
Fakulta textilní

Recommendation of the supervisor

Supervisor´s opinion on Ph.D. thesis

Ph.D. candidate: Moaaz Ahmed Samy Moustafa El Deeb

Title of the work: Different Approaches for Predicting Air Jet Spun Yarn Strength

Doctoral study program: Textile Engineering

Supervisor: Ing. Eva Moučková, Ph.D.

Currently, yarns produced on air-jet spinning machines are increasingly applied, especially in the field of garment products. The process of forming the air-jet yarn in the spinning box is completely different from rotor and ring spinning technology. Thanks to it, air-jet yarns are featured by a different, specific structure (fasciated yarn). This, in case of optimally set machine process variables, makes these yarns stronger compared to rotor spun yarns. Concurrently, the air-jet yarns exhibits lower hairiness. Although there are many research works focused on air-jet yarn, they are primarily deals with the influence of the technological parameters on the properties of the air-jet yarns produced on Murata Vortex spinning machine (MVS) or simulation of air flow field in the MVS nozzle chamber. However, Rieter company introduced its air-jet spinning machine in the year 2009. It differs from the MVS by the machine concept, the nozzle geometry and fiber guide in front of spinning tip placed in the nozzle house. Therefore, the study of forming process of Rieter air-jet yarns together with the problematics of yarn strength and possibility of its prediction is an up-to date subject.

At presented Ph.D. thesis, the candidate focuses on the issue of yarn strength on a wider scale, which is in line with the objectives of the work. Therefore, the work is divided into 4 main chapters. The research part of the dissertation thesis includes current knowledge in the area of air-jet spinning and the prediction of the air-jet yarn strength. In the first main chapter, the student tries to clarify the process of yarn formation using the numerical modeling of airflow field in the nozzle. He points out the importance of nozzle pressure, which affects the arrangement of wrapper fibers in yarns and hence the structure of the yarn, which, to some extent, reflects in the yarn strength. In the second part, based on experimental measurements, the student compiled a multiple regression model of yarn strength in dependence on the yarn count, the nozzle air pressure and delivery speed. In the third part the student proposed and experimentally verified the mathematical model of yarn strength on short gauge lengths. During the model creation, he proceeded logically with regard to the specific yarn structure and the use of research work. Yarn strength predicted using the proposed mathematical model fits to experimental yarn strength very well. Within the work, the student suggested new method of calculation wrapper fiber ratio and was able to critically evaluate its weaknesses. In the last main part he presented statistical model for prediction of air-jet yarn strength at different gauge lengths based on Neckar´s model. In this part he compared obtained results with results of ring and rotor spun yarn.

His publication activities are in very good level. The candidate is a main author or a co-author of:

- 5 papers published in the impact factor journals indexed in WOS database,
- 1 paper published in a journal indexed in Scopus database only and
- 2 papers in other journals.

Today, 3 next papers are in press in the impact factor journals. He also published 6 articles at conferences and seminars.

Ph.D. student Moaaz El Deeb worked out the thesis with interest and initiative. During work solution, he clearly demonstrated both the ability to work independently and the ability of logical thinking in connection with the application of models and their derivation.

Therefore, I recommend this Ph.D. thesis for the defense.

V Liberci 8. 6. 2017

Ing. Eva Moučková, Ph.D.
KTT