Fabirc Topography Influence on Nanofibers Deposition

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INTRODUCTION

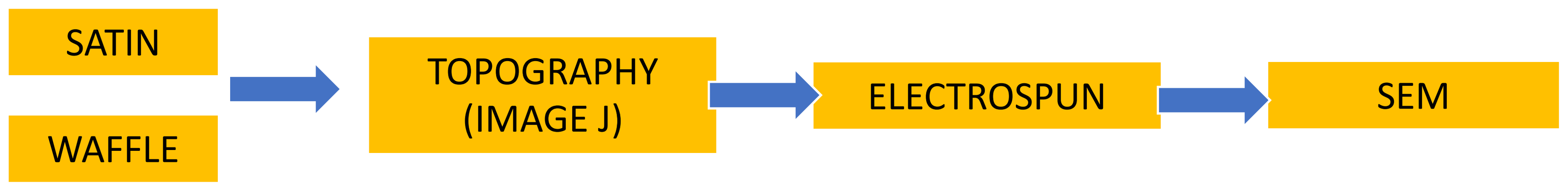
According to the National Science Foundation (NSF), the term nanotechnology covers engineering and utilization of a functional structure with minimum one dimension on nanoscale [1]. The nanofibers have become popular for several reasons and statistic forecasts indicate that the global market value of nanofiber products will increase from 0.93 up to 4.3 billion U.S. dollars from 2018 to 2023 [2]. Nanomaterials and systems are interesting since they due to their size can be fabricated to perform novel and enhanced chemical, biological and physical properties and processes [3].

Electrospinning technology had its first commercially valuable patents publish from 1934 [4] to 1944 [5] by Formhals for solvent-based electrospinning and the use of melt was patent 1936 by Norton [6]. Thanks to the progress in nanofibrous and electrospinning research, different process parameters have been highlighted to determine the final features of electrospun fibers [7]. By knowing how to control these specific parameters, a good control of the fiber morphology can be realized and the final nanostructure can possess excellent mechanical features certainly flexibility, big specific surface area, high aspect ratio, surface functionality, low density, changeable fiber production from one to three dimensions, and high porosity if desired.

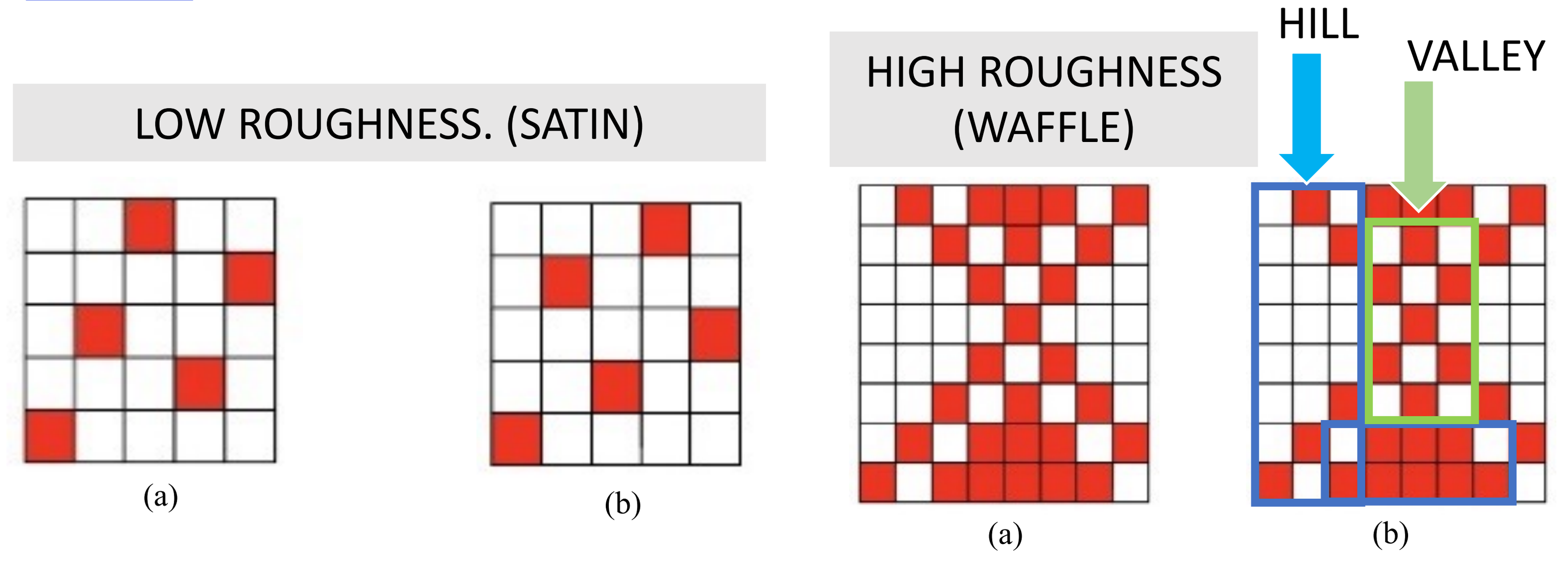
Due to the construction of textile fabrics based on yarn interlacements, they are not appearing with completely flat nor smooth surfaces. Instead, a fabric shows surface irregularities which directly influences the tactile characteristics of the fabric but also has a big impact for further processing [8]. When discussing surface characteristics of a fabric or another material type, it is valuable to break surface down into form, waviness and roughness. These three parameters are together creating the materials original profile and are important to distinguish from each other. Per definition, form, waviness and roughness are the terms for low, mid, and high frequency range variance respectively [9]. The initial profile for some components may have a substantial form, such as a radius. For conventional textiles however, two dimensional (2D) fabrics more or less, the form could be defined as flat meanwhile waviness and roughness profiles are more of interest to define. In this study authors aim to study the influence of the fabric topography on the nanofiber deposition.

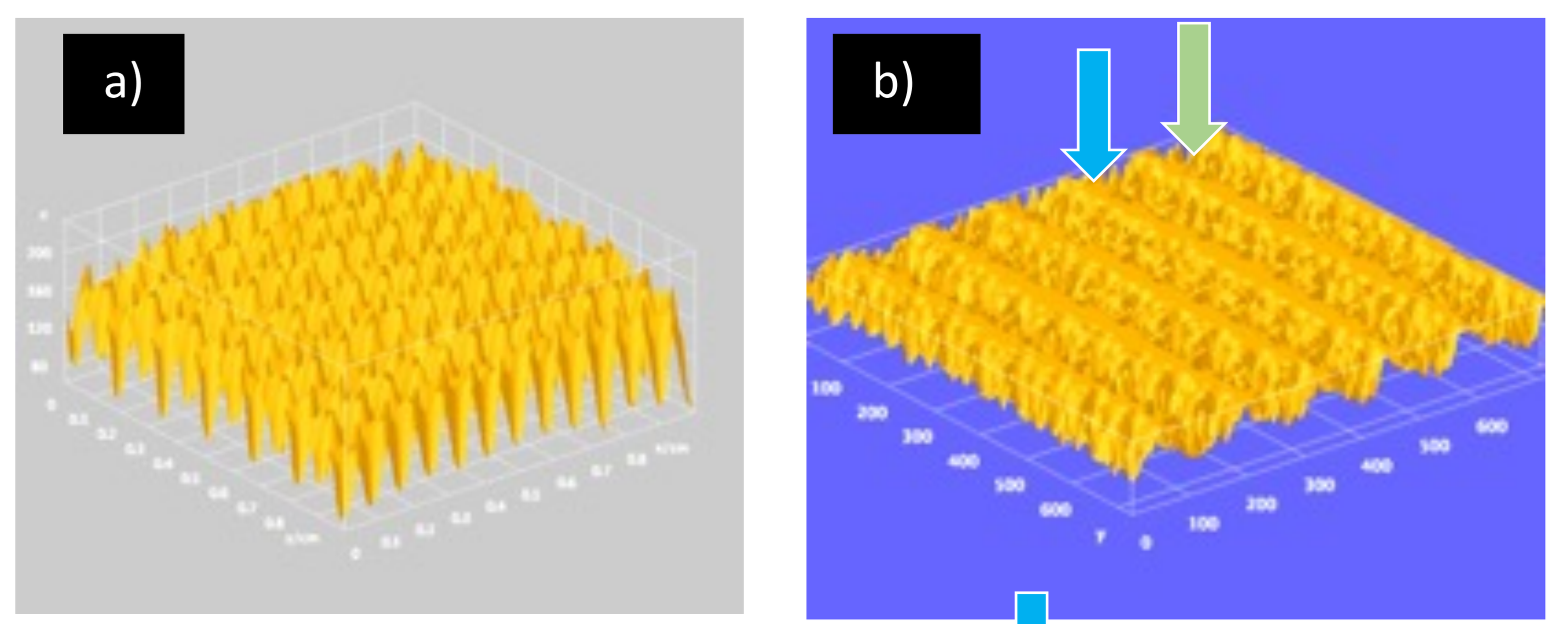
MATERIALS & METHODS

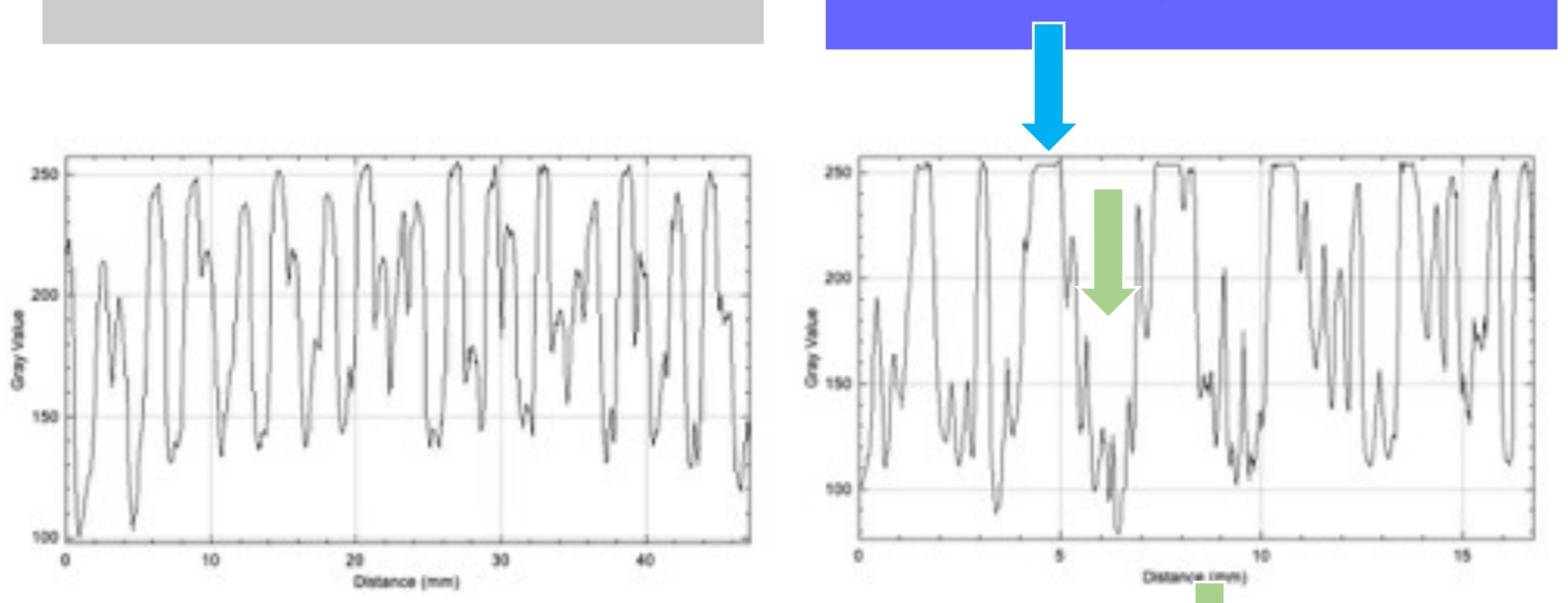
Two 100 % polyester fabrics with considerable differences in their topography were used to be coated by electrospun fibres. Bioinicia nanospider was used to coat the fabric. Image J software was used to evaluate topography.

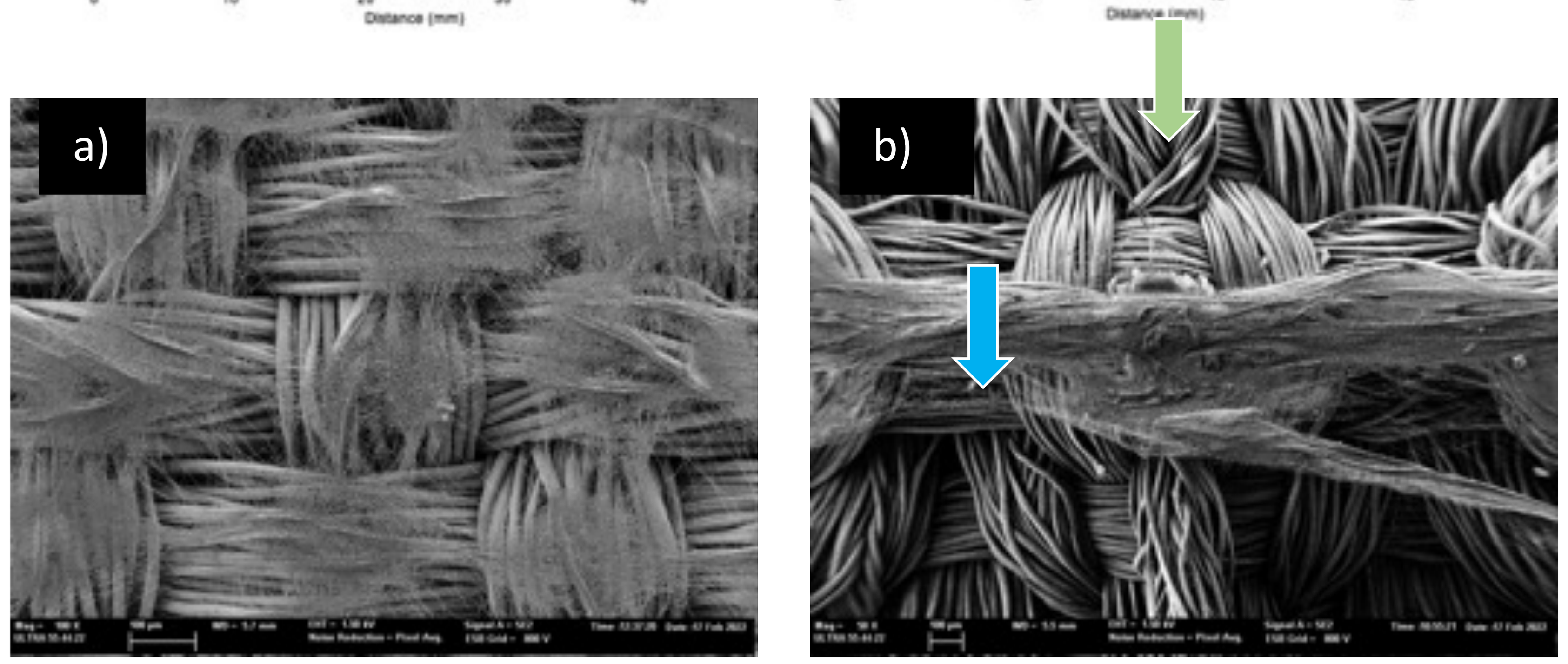


RESULTS









CONCLUSION

In this study, two wave patterns with clear differences were selected. Such considerable differences have been demonstrated by software analysis and they were useful to demonstrate diverse behaviour on the deposition of nanofibers on the fabric surface.

Results from this study demonstrate there is an inverse relation on the homogeneity of nanofibers coating and the roughness of the fabric. The higher the abrupt topography on the fabric, the higher time is needed to cover the whole surface with the nanofibers coating.

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