CHARACTERISATION OF THE SURFACE GEOMETRY OF SEERSUCKER WOVEN FABRICS

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ABSTRACT

The seersucker woven fabrics are characterized by a unique structure and properties resulting from the structure. In the seersucker fabrics the puckered and flat strips occur in turns according to the repeat of the seersucker effect. The structure of the seersucker woven fabrics influences their mechanical, utility and comfort-related properties. The aim of presented work was to analyse the surface topography of the seersucker woven fabrics of different structure. Measurement of the parameters characterizing the surface geometry of the fabrics was performed by means of the MicroSpy® Profile by the FRT the art of metrology ™. On the basis of the results from the profilometer the parameters characterizing the surface topography of the investigated seersucker woven fabrics were analysed. It was stated that the repeat of the seersucker pattern influences the surface parameters of the investigated seersucker woven fabrics.

Key Words: seersucker fabrics, roughness, surface profile

1. INTRODUCTION

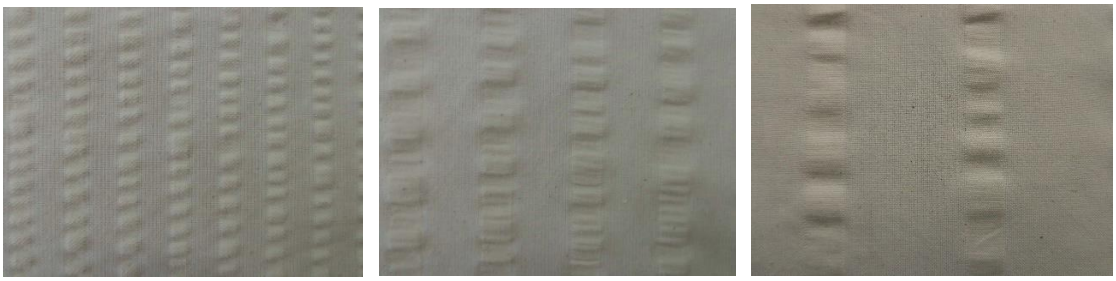
The seersucker fabrics create a unique 3D woven structure. Sometimes such structure is considered as 2.5D+. The word “seersucker” came into English from Persian, and originates from the words: "Sheer" and "Shakar". They meaning is: "milk and sugar", probably from the similarity of smooth and rough stripes along the fabric to the smooth texture of milk and the lumpy texture of sugar [1].
The seersucker woven fabrics are characterized by a unique structure and properties resulting from the structure. In the seersucker fabrics the puckered and flat strips occur in turns according to the repeat of the seersucker effect. The seersucker effect is created on a loom due to an application of two warp sets of different tension [2]. The structure of the seersucker woven fabrics influences their mechanical [3], utility and comfort-related properties. In order to model the properties of the seersucker woven fabrics it is necessary to quantify the geometric structure of their surface.
The aim of presented work was to analyse the surface topography of the seersucker woven fabrics of different structure.

2. MATERIALS AND METHODS

Three variants of the cotton seersucker woven fabrics were the objects of the investigations. The seersucker fabrics being investigated differ between each other in the range of width of the puckered and flat strips. Three variants of pattern of the seersucker effect were applied in the investigated fabrics:

- variant 1 (MM1) – width of puckered and flat strips appropriately: 5 mm and 8 mm,
- variant 2 (MM2) – width of puckered and flat strips appropriately: 9 mm and 18 mm,
- variant 3 (MM3) – width of puckered and flat strips appropriately: 11 mm and 41 mm.

Pictures of the fabrics are presented below.



a) b) c)

Figure 4. Pictures of the investigated fabrics: a) variant MM1, b) variant MM2, c) variant MM3

The basic properties of the investigated fabrics are presented in Table 1.

Table 1: Basic structural properties of the investigated fabrics

Parameter	Unit	Value		
		Variant MM1	Variant MM2	Variant MM3
Weave – warp I	-	plain		
Weave – warp II	-	rep 2/2		
Warp density	cm^{-1}	12.7	12.6	11.4
Weft density	cm^{-1}	11.4	11.5	11.4
Mass per square meter	$g\ m^{-2}$	212.9	207.8	192.8
Take up – warp I	%	8.3	6.0	5.2
Take up – warp II	%	49.8	48.8	49.7
Take up - weft	%	7.1	6.4	9.2

In order to assess the surface topography of the investigated fabrics the MicroSpy® Profile profilometer was used. It is an optical measuring tool for the precise measurement of surface topographies. The results from the profilometer were analysed using the Mark III software. Before analysis the results from the profilometer were filtered in order to eliminate the noise.

3. RESULTS

The basic properties of the surface topography of the investigated fabrics were determined according to DIN ISO 25178 standard. They were among others the height and volume function parameters:

- S_a – arithmetic mean of the absolute of the ordinate values within a definition area.
- S_q – root mean square value of the ordinate values within a definition area. It is equivalent to the standard deviation of heights.
- V_{vv} – dale void volume at p material ratio. This parameter represents the void volume of dale at areal material ratio p%.
- V_{vc} – core void volume. It expresses the difference in void volume between p and q material ratio. This parameter represents the difference between the void volume at areal material ratio p% and the void volume at areal material ratio q%.

Additionally, the fractal dimension (*FD*) was calculated for each fabric variant. A fractal dimension is a ratio for figuring out the complexity of a system given its measurement. Applied software provides fractal dimension which represents a quantity for the fracturing of a surface (and consequently the roughness) [4]. Results of measurement of the surface parameters according to the DIN ISO 25178 standard are presented in Table 2.

Table 2. Results from the profilometer

Parameter	Unit	MM1	MM2	MM3
S_a	mm	0.0184	0.0150	0.0122
S_q	mm	0.0404	0.0428	0.0292
V_{vv}	mm^3/mm^2	5.3508	4.5708	3.0406
V_{vc}	mm^3/mm^2	24.3516	15.309	13.5062
FD	-	2.052	2.045	2.036

Applied device provides many others parameters characterizing the surface topography of the investigated objects. It is possible to analyse the histograms of height, the parameters of the profiles prepared in predetermined places, angle distribution, hone angle and many others. On the basis of the presented results we can clearly see that using the MicroSpy® Profile profilometer data it is possible to characterize the surface topography of the seersucker woven fabrics. Some parameters such as S_a, V_{vv}, V_{vc} and *FD* show the significant differences dependably on the repeat of the seersucker effect.

4. CONCLUSIONS

Presented investigations should be considered as preliminary. The research confirmed that the results from the MicroSpy® Profile profilometer clearly show a diversity of surface topography of the seersucker woven fabrics with different repeat of the seersucker effect. Applied method and software provide bigger number of characteristics of the surface topography. Investigations are continued.

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3. REFERENCES

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