THERMAL PROPERTIES OF HYBRID KNITTED FABRICS FOR ELECTROMAGNETIC FIELD SHIELDING

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Abstract: *Many researchers have been involved in the development of textiles with electromagnetic radiation (EMR) shielding properties. Flexible protective screens based on textiles are used for human protection – metal fibers containing textiles or textile materials with surface nanomodification. If any textile comes into the contact with human skin, it is necessary to know its comfort properties. In this study hybrid knitted fabrics with different ratio of steel wire in structure are investigated. Their thermal properties as main indicators of comfort properties are studied.*

Key words: *electromagnetic radiation, thermal properties, hybrid knitted fabrics.*

1. INTRODUCTION

The basic function of clothing which is used was and is to protect people from the influence of weather. Later on social function came up and in present time other different functions are in many cases entering. Among this special needs protection against EMR belongs. At the textiles which are determined for production of garments having the protection against EMR some comfort is expected as the state of wellbeing is required from wearer. This state is connected with thermophysiological and sensorial parts of the clothing comfort. The design of textile has strong influence on the clothing comfort perception. Thermophysiological characteristics as tactile feeling, heat and moisture transfer belong among the most important. Thermophysiological comfort is associated with the ability to retain or dissipate heat or remove moisture from the body surface. Therefore, when the ability of a fabric to help create well-being during wear is required, a number of properties related to thermophysiological comfort need to be measured.

2. EXPERIMENTAL

The knitted samples containing different amount steel wire (SS wire) were prepared.

Table 1: Basic structural characteristic of knitted samples

sample no.	composition [%]		areal weight [g/m-2]	stitch density per 100 mm		thickness [mm]
	cotton	SS wire		wales	courses	
K1	100	–	420	40	60	1.4
K2	93	7	300	40	40.4	1.4
K3	71	29	245	40	60	1.4
K4	70	30	285	40	50	1.6
K5	49	51	290	30	60	1.4
K6	-	100	160	40	50	0.8

The samples were produced on 8-gauge flat knitting machines. The fineness of used cotton yarn was 30x2 tex and the SS wire had diameter 0.12 mm. The cotton yarn a SS wire was fed separately and feeders were changed after every two courses. In present study the following properties connected with thermophysiological part of textiles were measured using the instrument Alambeta: thermal absorbtivity *b*, thermal conductivity *λ* and thermal resistance *r*.

3. RESULTS

The results of properties connected with thermophisiological comfort are presented in Table 2 where aritmetic means and standard deviations (in parenthesis) are shown. At the measured samples the thermal conductivity *λ* lie between 0.0415 and 0.069 [W.m^{-1}K^{-1}]. The highest and the lowest values were reachd by samples consting of only cotton or steel wire, respectively. Although statistical analysis shows in many cases the statistically significant differences in results the practical differences among the samples containg different portion of steel (samples K2 – K5) wires did not exceed approximately 6% (0.0537 (K2) against 0.0567 (K4)). No trend was detected. The similar characteristics of results is possible observe for all other measured thermophysiological samples. The extremes were measured on samples made of pure cotton or steel wire only. However, the relative differences among the samples containing different ratios of cotton and steel wire (samples K2 - K5).

Table 2: The thermal properties

sample no.	$\Lambda\ [W.m^{-1}.K^{-1}]$	*b* [W.m^{-2}s$^{1/2}$ K^{-1}]	*R* [K.m^2 W^{-1}]
K1	0.0690 (0.00084)	117.3 (5.51)	0.0374 (0.00053)
K2	0.0537 (0.00197)	85.0 (4.4)	0.0415 (0.00137)
K3	0.0546 (0.00079)	80.8 (4.83)	0.0395 (0.00051)
K4	0.0567 (0.00192)	66.7 (5.33)	0.0508 (0.00145)
K5	0.0552 (0.00173)	80.9 (5.06)	0.0463 (0.00154)
K6	0.0415 (0.00156)	50.3 (1.97)	0.0300 (0.00166)

4. CONCLUSIONS

The influence of the ratio of steel wire on changes in properties connected with thermophysiological comfort were investigated. It was prepared 6 knitted samples with rib structures where wire was fe separately. The ratio of steel wire was 0, 7, 29, 30, 51 and 100%. Three properties connected with thermophysiological comfort were investigated: thermal absorbtivity, thermal conductivity and thermal resistance. Although the statistical differences were detected from the practical using these differences have less influence on feeling during wearing.

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5. References

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