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THERMOPHYSIOLOGICAL COMFORT PROPERTIES OF TEXTILE SHIELDS AGAINST EMR

Purpose *Investigation of the influence of structure and composition of hybrid fabric shields against EMR on the ability to provide thermophysical comfort*
Key words: *electromagnetic radiation, comfort, hybrid fabric*

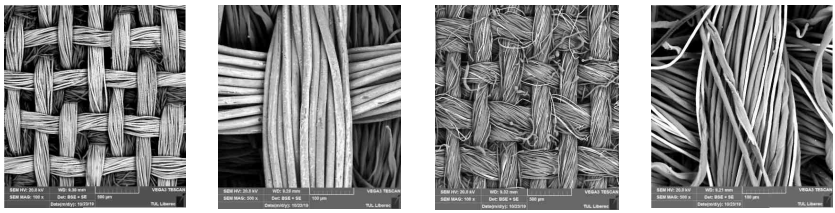
Introduction In recent years, the pollution of the environment from electromagnetic radiation (EMR) has increased at least a million times and has become global. The level of electromagnetic radiation is much higher than the natural level, which was established during the development of biosystems. Flexible textile screens can be one of the effective means of EMR shielding. The main methods of obtaining textile materials for EMR shielding are using of metallized fibers and threads or the application of a metallized layer on the surface of the material [1].

Materials and methods Two metal fiber-containing hybrid fabrics (by firm YSHIELD) were investigated. The characteristics of hybrid fabrics are presented in Table 1**.** Figure 1 presents scanning electron microscope (SEM) images of hybrid textile shields against EMR (the lightest and smoothest fibers are metal fibers.

Table 1 – **Characteristics of hybrid fabrics**

Sample	Composition	Mass per unit area, [g/m^2]
SILVER-TWIN	Cotton 50%, PET 35%, Silver 15%	150
STEEL TWIN	Cotton 68%, PET 16%, Stainless steel 15%	190

The thermophysical characteristics (the thermal conductivity (λ), the thermal absorptivity (b) and the thermal resistance (r) were measured using the instrument Alambeta. The shielding efficiency (SE[dB]) was realized using device consisting of vector analyser Rohde & Schwartz ZNC3. The device enables cover frequencies from 9 kHz to 3 GHz. Total SE (dB) with the use of test fixture EM-2107A (ElectroMetrics) was observed.



SILVER-TWIN STEEL TWIN

Fig. 1. **Scanning electron microscope images of hybrid fabric shields against EMR**

Results Investigations of shielding efficiency have shown that fabrics have sufficient shielding ability according to the classification "professional use" according to FTTS-FA-003:2005 Specified Requirements of Electromagnetic Shielding Textiles:

– SILVER-TWIN has a “very good” shielding ability (60dB≥SE>50dB);
– STEEL TWIN has an “average” shielding ability (40dB≥SE>30dB).

The results of properties connected with thermophisiological comfort are presented in Table 2. The objective measurement of thermophysical comfort of fabric are determined by the thermal absorptivity (*b*). This parameter enables to evaluate the fabric's character in the aspect of its "warm – cool" feeling. The fabric SILVER-TWIN has higher value of thermal absorptivity and give cooler feeling. This is due to the high thermal conductivity of silver (λ=428 $W \cdot m^{-1} \cdot K^{-1}$) compared to the thermal conductivity of stainless steel (λ=45 $W \cdot m^{-1} \cdot K^{-1}$).

Table 2 – **The thermophysiological properties of hybrid fabrics**

Sample	λ, $[W \cdot m^{-1} \cdot K^{-1}]$	*b*, $[W \cdot s^{1/2} \cdot m^{-2} \cdot K^{-1}]$	*r*, $[K.m^2\ W^{-1}]$
SILVER-TWIN	0,0501	209	0,006
STEEL TWIN	0,0402	160	0,008

Conclusion It was found that metal fiber-containing hybrid fabrics (by firm YSHIELD) satisfy the requirements for functionality: good shielding ability (60dB≥SE>30dB) and high thermophysiological properties (b= 160÷209 $W \cdot s^{1/2} \cdot m^{-2} \cdot K^{-1}$).

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