SURFACE CONDUCTIVITY ANALYSIS ON ELECTROCONDUCTIVE WOVEN FABRICS FOR ELECTROTHERAPY APPLICATIONS

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Abstract: The research aim was to analyze the surface conductivity of electroconductive woven fabrics in terms of their application as electrodes for electrotherapy. The uniformity of electric current distribution on the fabric surface is significant for the safety and effectiveness of electrotherapy treatments [1]. Therefore, the electrical anisotropic nature of the woven fabrics [2] was considered, where the directional orientation of weft and warp threads influences the electrical resistance in the sample plane. Electroconductive woven fabrics were classified in terms of anisotropic and isotropic materials, and suitability as textile electrodes was carried out.

Keywords: *woven fabric, electrical properties, anisotropy, electrotherapy, textile electrodes.*

Four plain weave fabrics were woven from electrically conductive twisted silver plated yarn Shieldex® 117/17 HCB. Different densities of weft were chosen, assuming the same density of warp. The Van der Pauw method [3] was used to measure the electrical resistance of samples. Two possibilities for arranging the electrodes on a fabric surface were considered: M - four electrodes placed on the edge of the circular sample (with a diameter of 7 cm) and forming a square 4 cm x 4 cm, S - four electrodes placed concentrically with the circular sample and forming a square 2 cm x 2 cm. The direction-dependent resistance of electroconductive fabrics in the form of isotropy and anisotropy curves are shown in Figures 1-4. The isotropy curves represent the mean values of resistances RmM and RmS connected with electrodes arrangement (M and S, respectively).

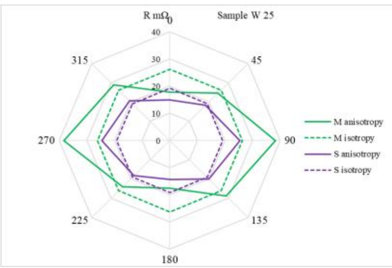

Figure 1 Isotropy and anisotropy curves for sample W25

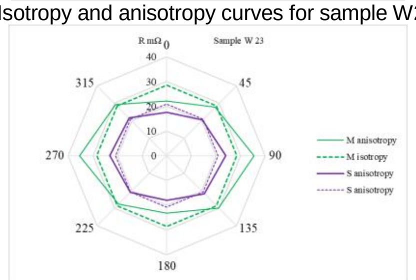

Figure 2 Isotropy and anisotropy curves for sample W23

Values of resistances RmM and RmS are given in Table 1. Moreover, the anisotropy coefficient D% was calculated to classify woven fabrics as anisotropic and isotropic materials.

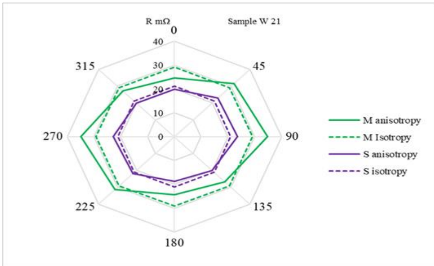

Figure 3 Isotropy and anisotropy curves for sample W21

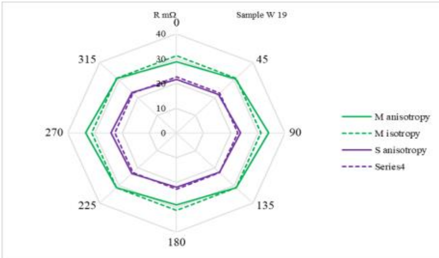

Figure 4 Isotropy and anisotropy curves for sample W19

Table 1 Characteristics of woven fabrics

Fabric	RmM	RmS	D%M	D%S
W25	26.24 mΩ	19.17 mΩ	14.7%	7.2%
W23	28.47 mΩ	20.81 mΩ	4.9%	2.0%
W21	29.25 mΩ	21.12 mΩ	3.6%	1.2%
W19	31.21 mΩ	22.67 mΩ	0.6%	0.2%

The small value of the anisotropy coefficient D%=0.2% indicates that fabric W19 can be treated as an isotropic material. This plain weave fabric is characterized by the comparable density in the warp and weft directions.

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