Experimental Research on Dissipative Textile Structures

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Abstract

Man-made fibers have the propensity to generate static electricity which becomes dangerous for electronics and individuals. There are many efforts to diminish the accumulation the electrostatic charges through using the dissipative structures. In recent years, research has expanded on the dissipative materials using new composite textile fibers obtained with different technologies. A study on the electrical properties of textile materials is developed in [1]. Electro-textile term is introduced, covering a wide variety of functions, such as antistatic applications, electromagnetic shielding, electronic applications, infrared absorption or protective clothing in areas at risk of explosion. It shows that for a fabric to be dissipative, the electrical surface conductivity of its components must be of the order of $10^9 – 10^{13}$ $\Omega/\square$ [1].

In this paper an analysis of the dissipative properties of various types of textiles with double layer structure (Fig. 1). The experimental determinations have been made on the various samples of double-layer fabric consisting of cotton fibers and fibers with trilobal shape conducting core surrounded by a sheath of polyester (Fig. 2 and Fig. 3) [2]. The apparent surface and volume resistivity are obtained of order $10^{12}$, showing the dissipative properties of this class of fabric. Test method used to characterize the electrical charge dissipation capacity was electrical induction charging method (Table I) [3]. Assessing the charge dissipation capacity has been characterized by the obtained coefficient of protection, within the limits 0.78- 0.92 (Fig. 4). The charge decay time of the samples is of order 50 -150 ms, proving the capacity to dissipate electric charges (Fig. 5).

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|c|c|}
\hline
Sample & $E_{S_1}$ [kV/cm] & $S$ & $E_{S_0}$ [kV/cm] & $t_{50}$ [ms] \\
\hline
\hline
a & 1.260 & 0.90 & 6.30 & 150 \\
\hline
b & 2.162 & 0.82 & 1.081 & 100 \\
\hline
c & 2.076 & 0.83 & 1.038 & 100 \\
\hline
d & 1.218 & 0.90 & 0.913 & 50 \\
\hline
e & 0.97 & 0.92 & 0.556 & 50 \\
\hline
f & 2.186 & 0.82 & 1.092 & 150 \\
\hline
g & 2.74 & 0.78 & 2.06 & 50 \\
\hline
h & 2.30 & 0.84 & 1.015 & 100 \\
\hline
\end{tabular}
\caption{Electric field intensity, protective coefficient and charge decay time for textile samples}
\end{table}

References

[1] V. Šafářová, J. Grégr, ”Electrical conductivity measurement of fibers and yarns,” 7\textsuperscript{th} International Conference - TEXSCI, Liberec, Czech Republic, September 6-8, 2010