

Electrical Conductivity of Cotton Fiber and its Dependence on Fiber Quality

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Abstract:

The dependence of the electrical conductivity of cotton fiber on alloying and temperature was studied. The experimental results showed that the activation energy of the first sample was 0.92 eV, the activation energy of the eighth sample was 0.8 eV, and the activation energy of the twentieth sample was 0.58 eV. It can be seen that the electrical conductivity of the fiber depends on its maturity level and doping.

Keywords: cotton fiber, electrical conductivity, activation energy.

Introduction. Recently, several physical parameters of natural fibers, the sensitivity and conductivity of cotton and silk fibers to external influences, and the electrophysical and optical properties of some cotton varieties have been determined [1]. The photoluminescence spectrum of the fiber was obtained and its dependence on the type of cotton was studied [2]. It is known that the main characteristics of the surface of dry, raw cotton fiber consist of balls located at an acute angle (20-30°) to the axis of the fiber. Such a surface structure is associated with a configurational helical arrangement of fibrils, and helicity in the second walls is proved by detecting replicas in the opposite direction. In these parts, the direction of the hairs and layers has changed. The length is 10 μm and the interlayer distance is 0.55 μm [3-4].

In addition to hairs and folds, there will also be small cracks, pits and bumps. Most cotton varieties have reported that the surface of the fibers, when examined by electron microscopy, is almost identical, consisting of the above-mentioned elements and shapes.

Method. This work is devoted to the study of the electrophysical properties of Namangan-77 cotton fiber. According to research, the electrophysical properties of the fiber depend on its type, degree of entanglement and its location in the cotton.

We conducted our research on Namangan-77 cotton fibers. We prepared samples of cotton fibers from different parts of cotton and examined their electrical conductivity depending on temperature. The sample cotton was first boiled in distilled water for 0.5 hours in order to get rid of foreign substances. We dried the fiber and combed it using a fine-toothed comb, ensuring the parallelism of the fibers. For comparison, half of the fibers from the same seed were melted in a 10% alcohol solution of iodine °at a temperature of 60 C for 300-400 minutes. The number of parallel fibers should be between 5000-8000. The sample consists of 4-5 mm mutually parallel bundles of fibers with a mass of 20-30 mg and is dried at a temperature of 300K. Then we found out that depending on the location of the fiber in the cotton, its electrical conductivity is different. First, we prepared the sample from the fibers of the lower, middle and upper parts of the cotton without alloying, and then we prepared the sample by alloying the fibers located in the same place. We determined the temperature dependence of the electrical conductivity of the prepared samples (Fig. 1).

Results. Studies have shown that increasing the crystallinity of PT up to day 10 does not change the crystallinity and electrical conductivity for the next 10 days. The 50-day-old fiber has a high electrical conductivity, due to the opening of the bud and the addition of various crystals to the fiber, thus the increase in electrical conductivity is noted [5,6]. As a result of the experiments , the VAX of the prepared sample (Fig. 2) and the dependence of their electrical conductivity on temperature were determined. We observed that the electrical conductivity of the fiber doped with iodine increases by several orders at the temperature $T=300K$.

In the second stage of our experiment, we determined the activation energy of samples taken from cotton fibers from the 1-8 and 20 branches of cotton. The activation energy of the sample taken from the first branch was 0.4eV, the activation energy of the sample taken from the eighth branch was 0.48eV, and the activation energy of the sample made of fibers from the twentieth branch was equal to 0.2eV. Then we made samples and conducted experiments with the fibers of the same branch alloyed at a temperature of 80 °C. The results of the experiment showed that the activation energy of the first sample is 0.92eV, the activation energy of the eighth sample is 0.8eV, and the activation energy of the twentieth sample is 0.58eV. It can be seen that the electrical conductivity is highly dependent on its level and alloying.

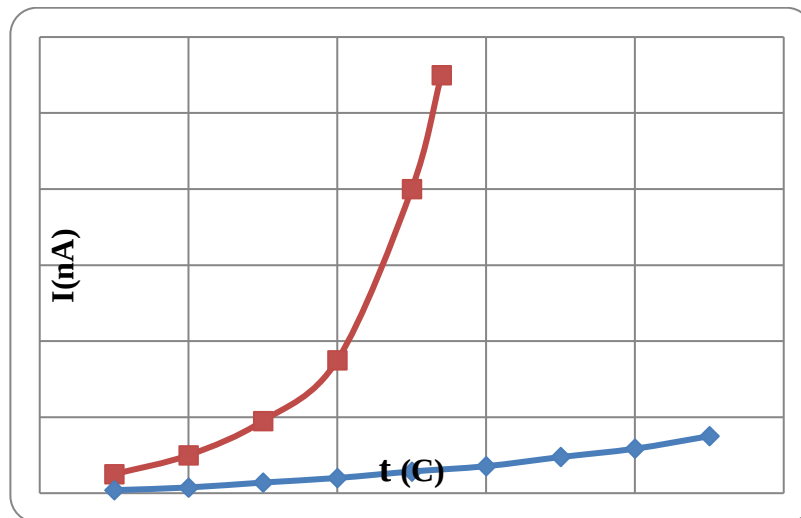
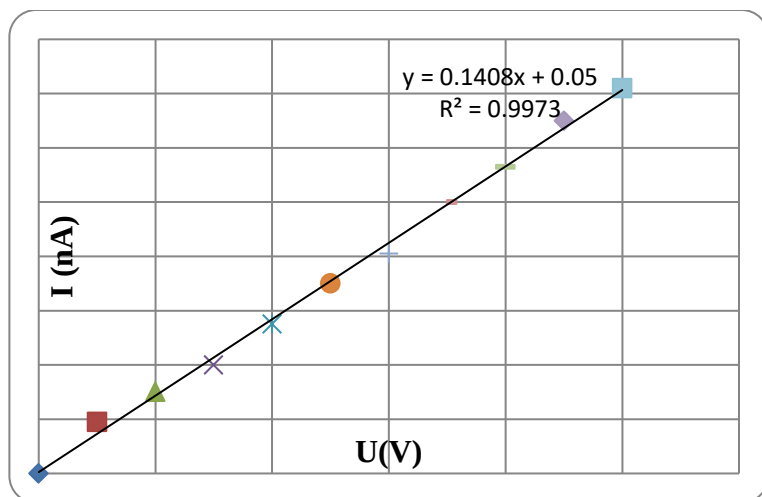


Figure 1. Temperature dependence of electrical conductivity of Namangan 77 cotton fiber ■- alloyed, ◆-unalloyed fiber.



2 - picture. Volt-Ampere characteristic of Namangan 77 cotton fiber

We can see that the electrical conductivity of the fiber increases after alloying. It can be seen that when the fiber is doped, the concentration of current carriers in it increases. This means that fiber can be used to create electronic devices in the future.

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