STUDY OF THE ELECTROPHYSICAL PROPERTIES OF "SURKHON-104" GRADE COTTON FIBERS ALLOYED WITH $KMnO_4$

ABSTRACT

In the production of $KMnO_4$ in cotton fibers "Surkhon-104", the filled levels $E_{t1}=E_c$-0,21 eV and $E_{t2}=E_c$-1,7 eV appear in the width of the scientific research zone, and these levels have donor character. The long-term relaxation of photoconductivity was determined, which is related to the localization of electrons to $E_{t2}=E_c$-1,5 eV levels. A zonal table of new fibers "Surkhan-104" doped with $KMnO_4$ is proposed to explain the obtained cottons.

Keywords: cotton fiber, electrical conductivity, photoconductivity, volt-ampere characteristic, diffusion

1. INTRODUCTION

Recently, plans have been made to investigate the physics of natural fibers. In particular, semiconducting properties of cotton fibers have been determined [1]. Cotton fibers alternate in crystalline and amorphous structures [2]. As a result of rapid evaluations of physical examination of natural semiconductor fibers in the body, it helped to create elements of electronic equipment, electronic moisture meter, diodes, photodiodes and transistors [3-8]. However, depending on the creations achieved, there are still many problems. The expansion of the building, its additional scope in the scientific direction opens wide opportunities for determining the electrophysical and optical settings of natural nanostructured semiconductor materials and for creating elements of discrete renewal of electronic devices based on them.

The physical condition of new cotton fibers "Surkhan-104" with fine fibers inside natural fibers has not been reported to date. In this article, we have studied the physical tests of the new thin fiber cotton fibers "Surkhan-104". The aforementioned fine-fiber cotton fibers were alloyed with $KMnO_4$ mixtures, and samples were prepared based on them, and the temperature dependence of electrical conductivity and photoconductivity spectrum were determined.

2. MATERIAL AND METHODS

Usually, the fibers from the ripened cotton seed are combed in a direction parallel to the surface of the flat object with a special comb. The parallel fibers were cut at 5 mm length, the fibers were washed several times with distilled water and dried at room temperature. For ohmic contact of the fibers, graphite and liquid glass are used. First, samples of untreated PTs were prepared, amplified from 0 to 100 V return, and the output volt-ampere characteristic (VAX) was determined. In this case, the current was $I_{max}\leq$0,5 nA. Treated with a 1.5% solution of $KMnO_4$ in distilled water, the PT was dried for 24 hours in a room and then diffused in a thermostatic device for 7-8 hours.

3. RESULTS AND DISCUSSION

VAX of the sample doped with $KMnO_4$ 1,5% solution was determined. The experiments were carried out at room temperature. As the voltage increased from 0 to 100 V, the current increased to 50 nA. As we can see from the decay lamps in Figure 1, we can see that the current is increased by several 10 times in the $KMnO_4$ doped cotton fibers compared to the doped cotton fibers. This is a typical location specification for basic input semiconductors.

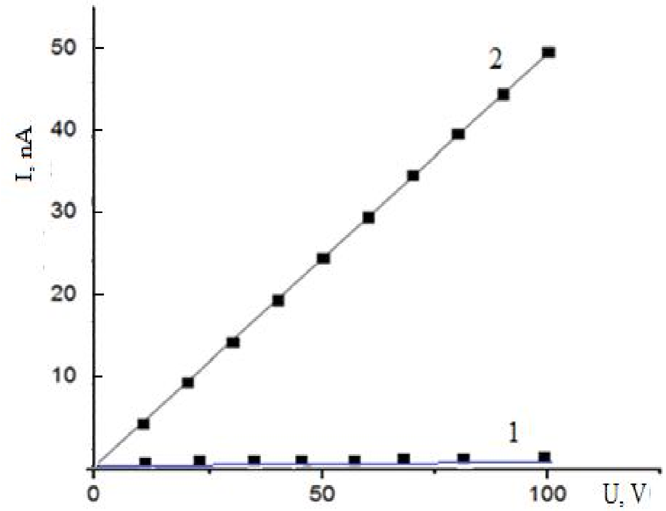

Figure 1. Volt-ampere characteristics of non-doped (1) and doped with $KMnO_4$ solution (2) "Surkhon-104" fine fiber cotton fibers. T=300K.

Generally, the conductivity of semiconductor materials varies exponentially with temperature. Cotton fibers have the same physical properties. For example, the electrical conductivity of cotton fibers is strengthened at room temperature. As the temperature increases, it can be seen that the electrical conductivity of cotton fibers also increases. It was found that "Surkhan-104" cotton fibers alloyed with $KMnO_4$, when subjected to a constant voltage of 100 V, the electrical conductivity increased exponentially and the ionization energy E_t=0,21eV was produced (Fig. 2).

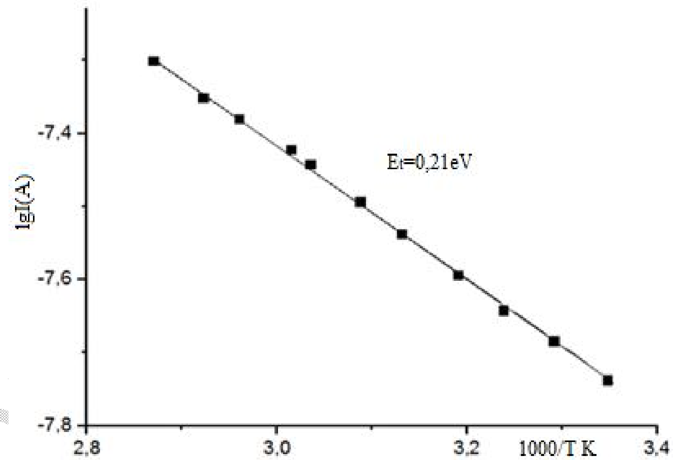

Figure 2. Temperature dependence of the electrical conductivity of "Surkhan-104" thin fiber cotton fibers doped with $KMnO_4$. Voltage U_{const}=100V. Activation energy E_t=0,21 eV

Photoconduction kinetic is required to detect physical changes in semiconductors under the influence of light. The kinetics of photoconductivity of "Surkhan-104" new fine fiber cotton fibers added with KMnO4 was studied during the regeneration process of ultraviolet (UV) light with energy hv=5 eV. According to the experiments, the photocurrent increased exponentially when the sample support was involved. A long-term relaxation of photoconduction was observed when the light beam was turned off (Fig. 3).

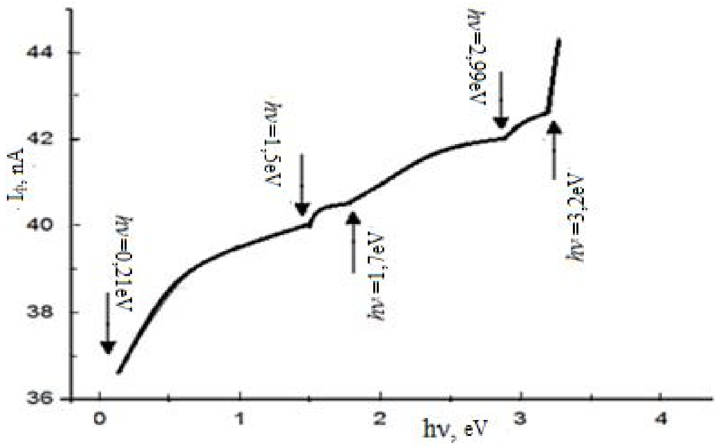

Figure 3. Change of electrical conductivity of "Surkhon-104" fine fiber cotton fibers doped with $KMnO_4$ 1.5% solution under the influence of ultraviolet light. Voltage U_{const}=100V

Here, in the monotonic view of the photoconduction spectrum, the photoionization cross section of electrons for both levels is larger than the photoionization cross section of holes. Let us assume that n-type semiconductors undergo transitions to fullness levels with increasing UV intensity. The measurement results of electrons transferred from C-zone to E_t levels for V zones show that "Surkhan-104" forms two levels when processing new PT: $E_{t1}=E_c$-0,21 eV and $E_{t2}=E_v$+1,7eV

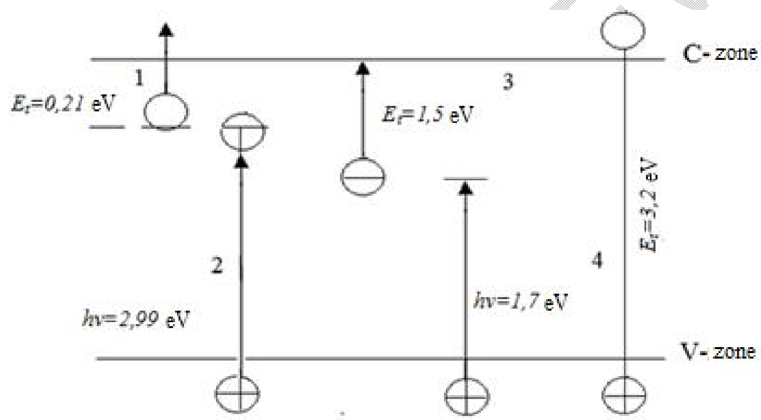

Figure 4. Zonal table of "Surkhan-104" thin fiber cotton fiber doped with $KMnO_4$

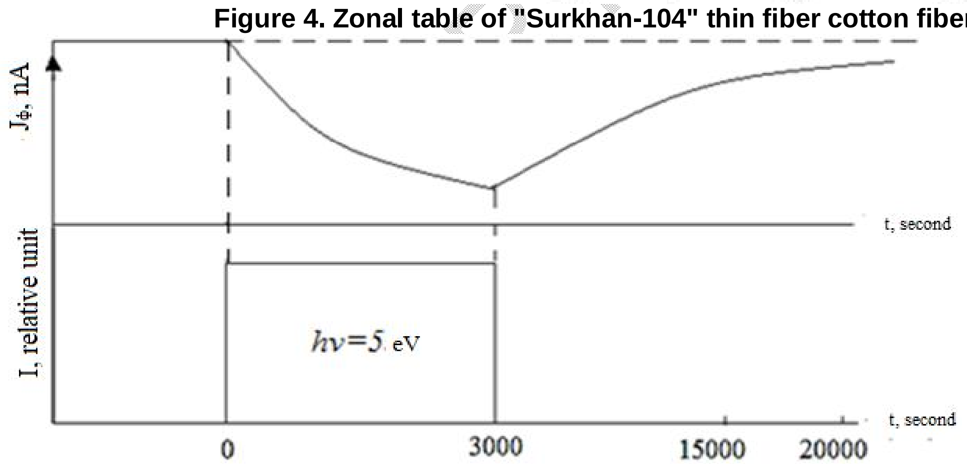

Figure 5. FO kinetics of the "Surkhon-104" thin-fiber PT sample doped with $KMnO_4$ solution in the off state, T=300K, shown by ultraviolet light

The "Surkhon-104" type fiber doped with $KMnO_4$ PT sample was observed to have unique process, negative photoconductivity phenomenon (Fig. 5). According to researches, in some materials, for example, various inorganic (doped-Si, PbTe, 2D materials), organic (graphene, carbon nanotubes) and organic-inorganic hybrid (haloid perovskites) materials recorded as a negative photoconductivity (NP). The opposite phenomenon is also regulated in the supplied power supply. The emergence of NP phenomena in semiconductors is still under discussion [9].

4. CONCLUSION

Electrophysical properties of "Surkhan-104" grade cotton fibers alloyed with $KMnO_4$ were studied. The technology of alloying $KMnO_4$ using the diffusion method is proposed. The volt-ampere characteristics of the sample, the temperature dependences of the electric current passing through the sample, the kinetics of photoconductivity (KP) (E_g-forbidden zone width) when the sample is illuminated with light with $h\nu \geq E_g$, and the photoconductivity spectra of "Surkhon-104" thin-fiber cotton fibers doped with $KMnO_4$ were studied. It was found that the structure of the volt-ampere characteristic is n^+-i-n^+ linear.

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