ABSTRACT

PHOTOCONDUCTIVITY OF CARBON NANOTUBE OBTAINED BY ARC DISCHARGE METHOD

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With the development of modern Nano science, interest in the study and study of carbon-based samples has increased. In the paper [1], R.G.Abaszade and others made the purchase of graphene-based samples by the Hummer method and the examination of the obtained samples was carried out. In [2-7,10] the structural and electrical properties of grapheme-based samples were studies were conducted for the application of these samples in solar panels. In addition to this, the application of examples in the modeling of hybrid energy systems and the modeling of voltage-ampere characteristics have been studies in detail.

On the basis of extensive research, it is intensively used in the preparation of new devices that are intensively applied in various fields of science. In addition, it is successfully used in the preparation of crystal cores of various elements in Nano electronics. The vast majority researches conducted in recent years have studied in detail the physical, chemical, mechanical, and electrical properties carbon-based nanotubes, as well as order characteristics. In the papers [7-9], the study of carbon nanotubes, carbon nanotubes doped with 10% and 15% gadolinium with different research methods, as well as their applications in the field of modern device manufacturing were studied.

In papers [11-12], the characteristic of the volt-ampere characteristic of the graphene oxide sample and its modeling were studied.

Our recent research is devoted to the photoconductive properties of CNTs. During the research, the photoconductivity spectrum of CNTs was investigated at a wavelength of $\lambda=400$-$900$ nm and in the voltage range of 1-$9$V, and it was determined that the spectrum of conductivity is more intense at lower voltage.

Modeling was carried out with the help of the MATLAB program. Based on the I-V characteristic of the spectrum at $\lambda \approx 720$ nm, it can be noted that very weak photosensitivity is observed with a 1-$9$V drop in the entire voltage range of the graph.

Figure 1 shows the dependence graph of the current intensity of the studied sample on the wavelength. The photosensitivity spectra of carbon nanotubes in the range of $\lambda=400$-$900$ nm were described at voltages U=1V, 3V.
Figure 1. The photosensitivity spectra of CNTs in the wavelength range $\lambda=400$-$900$ nm at two values of the bias voltage $U$ applied to the sample: $U=1$V and $3$V. The experimental points marked “o” in blue correspond to a voltage of $1$V; points marked with “x” in green correspond to $-3$V.

As can be seen from $U=1$V, seven photocurrent peaks were observed in the $\lambda=450$-$900$ nm range and showed a fairly even distribution: $\lambda_{p1} \sim 460$ nm, $\lambda_{p2} \sim 540$ nm, $\lambda_{p3} \sim 600$ nm, $\lambda_{p4} \sim 710$ nm, $\lambda_{p5} \sim 765$ nm, $\lambda_{p6} \sim 840$ nm, $\lambda_{p7} \sim 880$ nm. The highest photosensitivity $I_{p5} \sim 0.2 \mu$A observed in the spectrum was obtained at $\lambda_{p5} \sim 765$ nm. The value of peak $\lambda_{p4} \sim 710$ nm is quite insignificant. The remaining peaks have a photocurrent value of the order of $I \sim 0.5$-$0.11 \mu$A. Zero photosensitivity was observed in the wavelength range $\lambda=660$-$740$ nm ($\Delta\lambda=80$ nm).

A decrease in the number of peaks described at $U=3$V and their intensity is observed: $\lambda_{p1} \sim 410$ nm, $\lambda_{p2} \sim 460$ nm, $\lambda_{p3} \sim 502$ nm, $\lambda_{p4} \sim 680$ nm, $\lambda_{p5} \sim 755$ nm, $\lambda_{p6} \sim 860$ nm. The maximum peak depicted in the graph appears at $\lambda_{p2} \sim 460$ nm. This the value of the maximum has decreased and is $I_{p2} \sim 0.115 \mu$A. As can be seen from the graph, the maximum peak shifts to the lower wavelength region and the wavelength and it is observed as zero photosensitivity in the range of $\lambda=520$-$660$ nm ($\Delta\lambda=140$ nm), leading to the expansion of the range of zero photosensitivity.

References:


