STUDY OF SYNTHESIZED GRAPHENE OXIDE

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ANNOTATSIYA

Ushbu ishda yarimo'tkazgichli polimer materiallardan biri bo'lgan grafen oksidi sintezi va uning termal, skanerlash elektron mikroskopik tahlili amalga oshirildi. Uning fotofizik va fotokimyoviy xossalari ham o‘rganilib, bo‘yoqqa sezgir quyosh kameralarida qo‘llanilishi o‘rganilgan.

ABSTRACT

In this work, the synthesis of graphene oxide, one of the semiconductor polymer materials, and its thermal, scanning electron microscopic analysis were performed. Its photophysical and photochemical properties have also been studied, and their application in dye-sensitive solar cells has been studied.

INTRODUCTION

Graphene-based nanocomposites have been the focus of many researchers in recent years due to their excellent mechanical, electrical, and heat-resistant properties. Transparent graphene oxide electrodes with a large surface area can become an integral part of solar cells based on inexpensive organic polymer materials. Recently, graphene oxide and modified graphene oxide have been used as components for electron transport in new fast-growing solar cells based on organic perovskite. The basic operating principle of a graphene-based solar cell is actually not much different from that of inorganic silicon solar cells that are traditionally produced today. Some of the materials currently in use are being replaced by graphene derivatives [1].

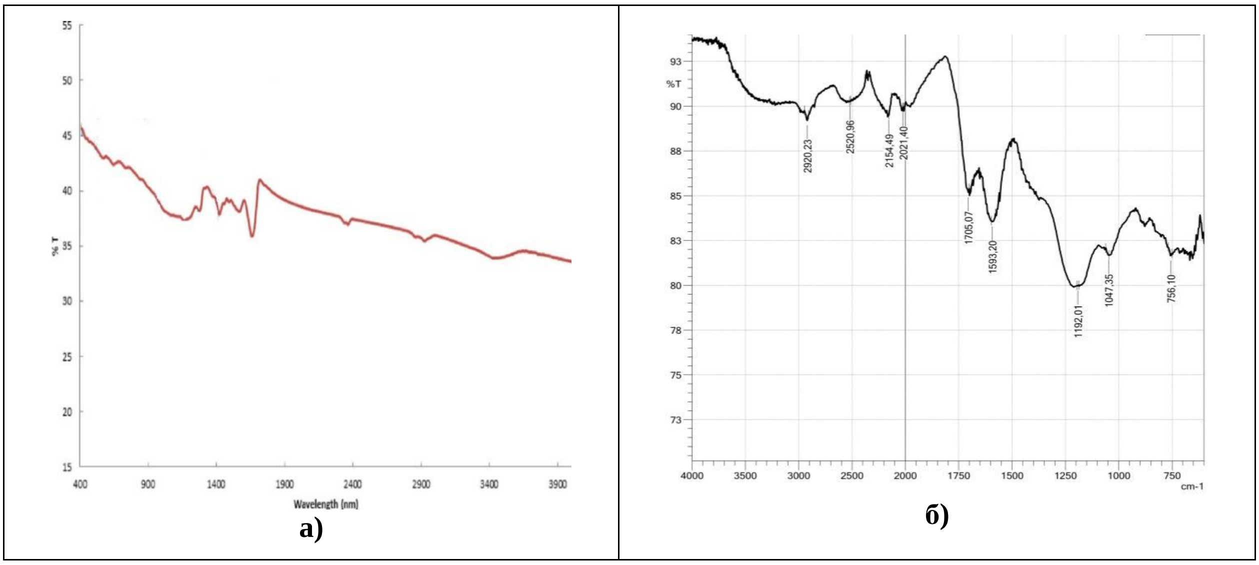
Today, non-composite polymers modified with graphene oxide are used in the production of organic perovskite-based solar cells due to the intensive increase in electronic transport layers. The dye also increases the efficiency of photocatalytic reactions for composites of TiO_2 titanium dioxide used in conjunction with graphene oxide, which is used as a photoanode in sensitive solar cells [2].

Superconducting composites can also be obtained from graphene and graphene oxide-based products. When small amounts of graphene or graphene oxide-based materials are added to non-conductive polymer resins, a superconducting mixture is formed. As the graphene oxide-based compounds added to the composition increase, the electrically conductive fillers begin to interact with each other, and the free electrons move easily, forming a diode path that conducts electricity. These superconducting composites are lightweight, corrosion resistant and can be easily adapted to meet specific manufacturing needs [3].

IR Spectroscopic Analysis of the Synthesized Graphene Oxide

Based on the results of infrared spectroscopy (IR) analysis of graphene oxide synthesized by oxidative polymerization, their analysis is presented.

This method of infrared spectroscopy (IR) is used to obtain absorption, emission and phototransmission spectra of solids, liquids or gases using infrared light. It can also be used to determine the composition of unknown compounds. In our study, infrared spectroscopy (IR) analysis was used to study bond interactions in graphene oxide formed from the reaction before and after the graphite oxidation process. Figures 4 a) and b) show infrared spectroscopic images of graphite and synthesized graphene oxide (GO). Graphene oxide shows absorption peaks confirming the presence of C-O functional groups with a vibration frequency of 1047 cm-1. Absorption peaks between 1593 cm-1 and 1705 cm-1 indicate that this C=C bond persists before and after the oxidation process. It is reported that a broad peak from 588 cm-1 to 3750 cm-1, due to the O-H region of H_2O water molecules adsorbed on graphene oxide (GO), refers to the frequencies of stretching vibrations of hydroxyl groups.



4-Fig. Infrared spectrum of a) graphite and b) graphene oxide.

Figure 2 shows a thermogram of the synthesized graphene oxide in a differential scanning calorimeter. Moisture loss was observed in the range of 50-120 ^{o}C on the thermogram. In the range of 150-200 ^{o}C, no thermal changes took place in the obtained substance, which indicates that the graphene oxide is heat-resistant and thermally stable. Decomposition of the substance took place between 250 ^{o}C and 400 ^{o}C.

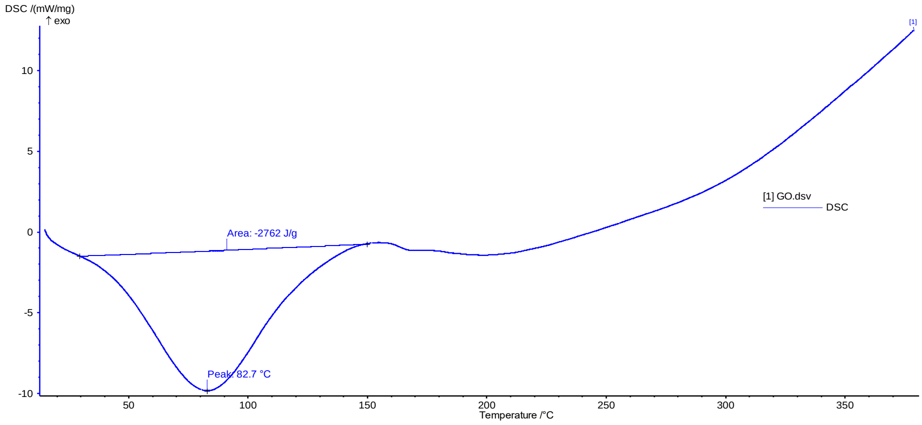


Figure 1. Thermogram of graphene oxide in a differential scanning calorimeter.

Graphene oxide has many beneficial properties that can increase the absorption efficiency of dye molecules to the photoanode layer of semiconductor titanium dioxide TiO_2, increase the interface area, and improve electron permeability to counteract the recombination effect of charges. Balancing the ratios of titanium dioxide TiO_2 and graphene oxide is critical to achieve an efficient system. This is because the composite obtained on the basis of graphene oxide with titanium dioxide TiO_2, which is used as a photoanode, absorbs visible light, that is, increases the adsorption capacity and plays an important role in increasing the recombination rate of electron holes.

The direction we use is organic dye as a light absorbing dye pigment for sensitive solar cells, so the temperature will not be too high and we can use it without any obstacles due to its corrosion resistance. When we studied and analyzed the relationship of graphene oxide to inorganic and organic solvents, we found that graphene oxide was insoluble in water and alkali, and very soluble in dimitelformamide.

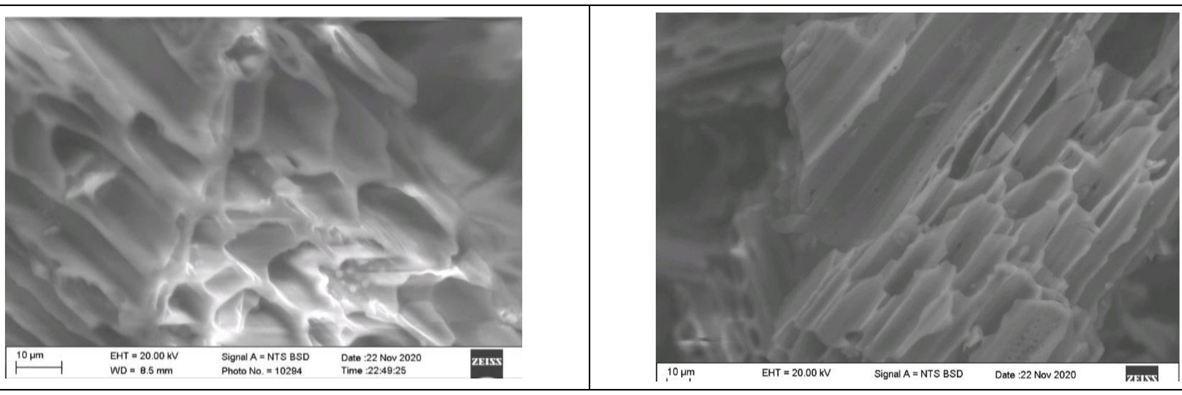


Figure 2. Imaging of graphene oxide on a scanning electron microscope.

Scanning electron microscopic analysis of graphene oxide synthesized as a result of chemical exfoliation and oxidation shows that under certain conditions of graphite oxidation, carbon atoms maintain the integrity of the two-dimensional structure of layers with oxygen functional groups attached to both sides and edges of the carbon plane. the rest. The carbon layers in multilayer graphene oxide are separated by functional groups attached to each layer of carbon atoms (Figure 2).

There is also a big difference between graphene oxide and graphite in scanning electron microscopy images, and although both are two-dimensional carbon materials, the properties of graphite are far from those of graphene oxide. Graphite does not absorb visible light and has a very low electrical conductivity. Due to the pores in the graphene oxide layers and the large surface area, the composite treated with the semiconductor TiO_2 increases the viscosity of the dyes, which are sensitive to visible light. As a result, the above properties allow them to be used in paint-sensitive solar cells [4].

In conclusion, in addition to the synthesis of these semiconductor composite materials and the analysis of their physicochemical properties, we are conducting extensive research to improve their electronic transmission mechanisms, as well as to develop mechanisms to increase energy conversion.

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