

Отметим, что диссоциации димера воды на мономеры внутри фуллерена C₇₀ квантово-химически не регистрируется.

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SYNTHESIS OF NANOSTRUCTURED COMPOUNDS BASED ON GRAPHENE OXIDE AND THEIR PRACTICAL APPLICATIONS IN VARIOUS FIELDS OF SCIENCE AND ECONOMY.

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For its unique properties, graphene has become a universal material: in recent years it has gained significant attention from scientists in various fields, including the chemical industry. The two-dimensional sp²-hybridized layer of carbon atoms possesses a number of special electro-physical, thermal, optical, and mechanical properties. It also has a high specific surface area, mechanical strength, and low electrical resistance [1-2]. Graphene derivatives are widely used in various fields, including energy storage, nanoelectronic devices and batteries, biomedical applications, biosensors, cell visualization, drug delivery, and tissue engineering [3-5].

The practical application of graphene is based on the modification of bitumen binding additives used to obtain high-quality asphalt concrete. Graphene oxide is also introduced into bitumen emulsion as a reinforcing, adhesive, binding additive. It increases the surface adhesion properties for the gravel base of asphalt concrete. The identification of graphene oxide was carried out by 3D scanning laser Raman spectrometer. (ConfotecMR520) (Fig.1).

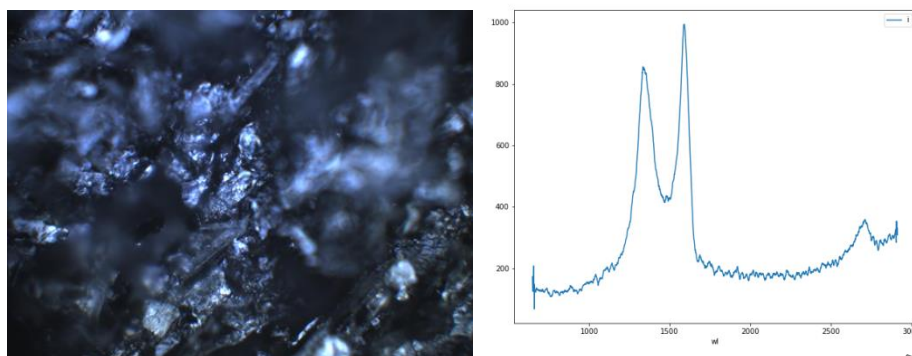


Figure 1. Microfilming and Raman-spectra of graphene oxide.

The figure 1 demonstrates that graphene oxide is a nanostructured material composed of non-amorphous crystals, which are in need of further studying by X-ray structural analysis. It can provide huge prospects for thorough investigation of the material and its and supramolecular characteristics. For example, we have worked on introducing graphene oxide into road bitumen at a content of 1-2% by mass. The figure 2 (b) shows that adding even small amount of graphene oxide greatly increases the adhesion of the modified bitumen compared to the original construction material. The reinforcing properties of the bitumen will be enhanced due to previously mentioned structural features of graphene oxide, which represent a polycyclic supramolecule. The cause is the proper oxidation of petroleum tar, resulting in the breakdown of asphaltenes into similar composite parts.

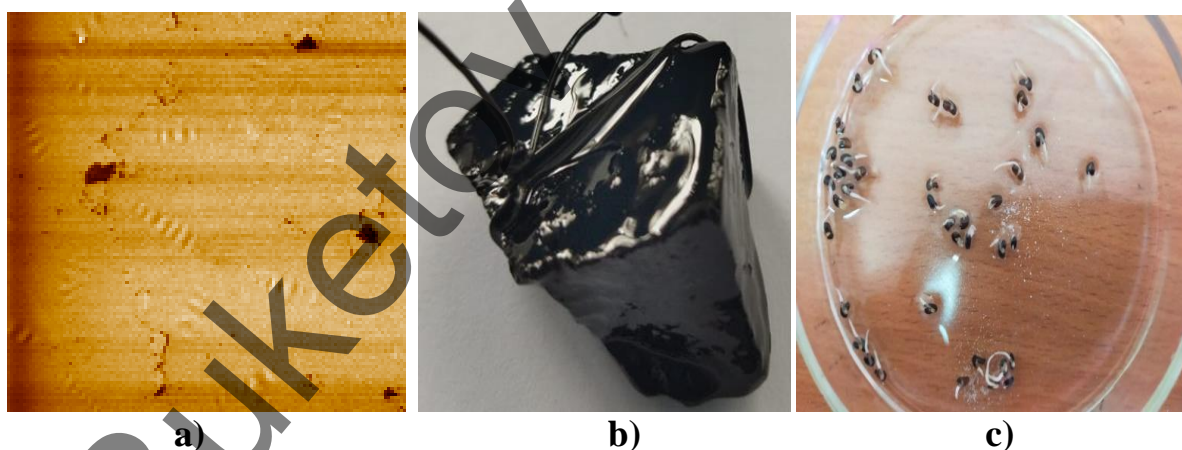


Figure 2. Photos using graphene oxide (a,b – bitumen, c - lettuce seeds).

The micrograph (fig. 2 a) demonstrates that due to modifiers addition, medium and small "bee" adhesion centers are visible, resulting in increased adhesion. There were no "bee" adhesion nanoparticulates in the microfilms of the original BND 70/100 grade bitumen sample, studied by atomic force microscopy. That indicates the poor adhesion of the bitumen to the mineral part and low adhesion of the asphalt concrete mixture.

The use of graphene oxide is promising in the biology, biotechnology, and agriculture fields, as its additives stimulate plant growth and protection [6,7]. Graphene compounds prolong the effects of mineral fertilizer, due to reduced migration of nutrients to lower layers of soil.

As can be seen from figure 2 c, graphene oxide introduced to lettuce seeds causes early germination and sprouting, occurring at a first day, while in the control sample, this process occurred only on the third day. That makes this type of nanocomponent a universal compound capable of causing a colossal effect in both the construction industry and agriculture.

Thus, the results of the experiments lead to the following conclusions:

- Optimal technological parameters for obtaining new methods of graphene oxide synthesis with maximum product yield have been established.
- Graphene oxide has been investigated as an adhesive additive to bitumen-based road construction materials;
- Graphene oxide has been used as a catalyst and carrier of mineral fertilizers in soil in order to accelerate the germination of plant biomass.
- The energy of seed germination and morphological characteristics of seedlings after soaking in solutions with graphene of different concentrations, as well as plant yield in open and closed ground with the addition of graphene oxide, have been studied.

This work is proposed as a startup, aimed at developing a reproducible method for obtaining graphene from available raw materials (technical carbon). The samples' characteristics using a modern complex of physicochemical analysis methods have been done. The experiments on the obtained graphene as a new nanomaterial for the needs of the road construction and agricultural industries has been carried out.

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ГЕЛЬ-ПРОНИКАЮЩАЯ ХРОМАТОГРАФИЯ В ИССЛЕДОВАНИИ НЕНАСЫЩЕННЫХ ПОЛИЭФИРНЫХ СМОЛ

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Исследование ненасыщенных полиэфирных смол с помощью гель-проникающей хроматографии является эффективным методом, который позволяет изучить молекулярные характеристики смол и оптимизировать процесс их синтеза[1].

Впервые на базе химического факультета Карагандинского университета им Е.А. Букетова была исследована абсолютная молекулярная масса ненасыщенных полиэфирных смол (п-полиэтиленгликоль малейнат и п-пропиленгликоль малейнат) с помощью метода гель-проникающей хроматографии на современном приборе ГПХ Malvernviscotek 270 maxdualdetector. Определены молекулярно-массовое распределение НПС.

Этот метод имеет множество преимуществ, среди которых можно выделить быстроту и точность анализа [2,3]. Кроме того, гель-проникающая хроматография позволяет получить информацию о молекулярных характеристиках полимеров без их разрушения[4], что позволяет использовать исследованные образцы для дальнейших экспериментов [5].

Для проведения исследования с использованием гель-проникающей хроматографии были подготовлены образцы НПС отобранные во время процесса синтеза. Хроматографическое разделение было проведено на колонке Т-6000М для органических растворителей, где они разделяются на отдельные компоненты в зависимости от их молекулярных характеристик. Далее, на выходе из колонки происходит детектирование компонентов, которые записываются на графике в виде пика.

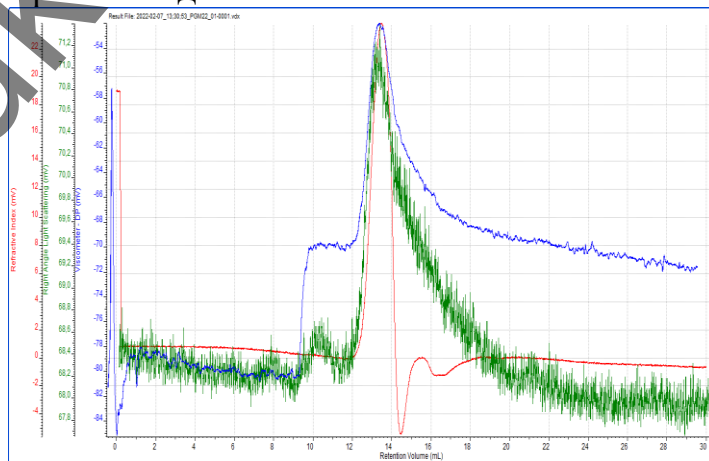


Рисунок 1 – Хроматограмма полиэтиленгликольмалеианата.