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GRAPHITE FROM GRAPHANE/GRAPHENE LAYERS

Abstract. The work was carried out on the example of carbon particles of the Kazakhstan manifestations. By electron transmission microscopy (TEM) it is shown, that carbon particles are capable to split. In work there is shown one of the ways of graphite formation. The probable circuit of formation of area of stratification is given. Graphite packing can arise from local "graphite" orderliness graphane/graphene carbon layers. Zones of "graphite" orderliness are formed locally. This is confirmed by the shown morphological and diffraction pictures (by TEM method). Thus, one more phase of orderliness of the carbonaceous substance forming a structural number has appeared.

Key words: carbonaceous particles, stratification, local packing.

Introduction. In nanotechnologies the methods for achieving a certain dispersion size are divided into two: "from top to bottom" and "from bottom to top" [1]. In geology, during the extraction of minerals, a method of dispergation - "from top to bottom" - was adopted. A large ettle is crushed into a certain "small" size. In the analytical work of natural substances a "top-down" method is also adopted - dissection to the desired component. In the processes of synthesis and in the ground mass of theoretical research "from the bottom up" processes are often used. The properties of atoms, molecules, substance constructed from fixed condition of the molecules, a mixture of substances are investigated [2]. At the nano-micro level these approaches come close, but each direction comes to this level with its own knowledge. For chemical synthesis processes materials of natural origin are "new". In spite of the fact that all precursors have been previously taken from natural sources, thay are purified from impurity substance. For example, carbon rocks. Determination of the substance by color is not always appropriate. It is known that carbon compounds do not always have black color. There are "white" compounds, for example, carbines. In the course of work on finding sources of nanocarbon in nature, it was found that so far many researchers in the field of chemical and geological sciences are still confused because of the misuse of carbon-graphite concepts.

We adhere to the classical definition that the structure of an ideal graphite is in a certain way connected in three-dimensional space of the carbon planes. Or graphite is a substance composed of crystalline packages consisting of 2–3 carbon layers parallel to each other. Not all carbonaceous matter can form a graphite structural order.

Result and discussion. The probability is high that individual layers of graphites are represented by graphene or graphane. (These formations are visible at considerable magnifications - probe microscopy and are calculated on mathematical schemes.) It is commonly known that, graphenes [3] are planar structures - slightly curved (wavy) sheets consisting of hexagonally packed carbon atoms. Graphene sheets [4] the tension of which is removed by hydrogen atoms are called graphan.

It is obvious that for incomplete [5] (insular) filling of graphane/graphene planes by hydrogen bonds, a local (nano-sized) occurrence of "graphite" orderliness is possible (Figure 2). And since the reflexes from the graphite packing are more intense (for electron diffraction in the TEM), then the manifestation of the "graphite" structure in the general non-graphite substance is expectable.

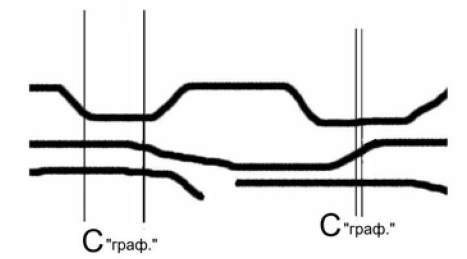
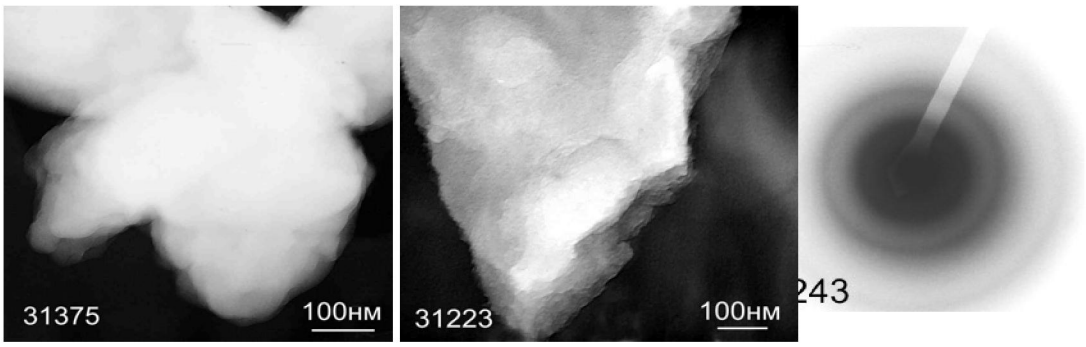


Figure 1 –
The schematic image:
the "graphite" structure
of a layer arising locally
(between two straight lines)



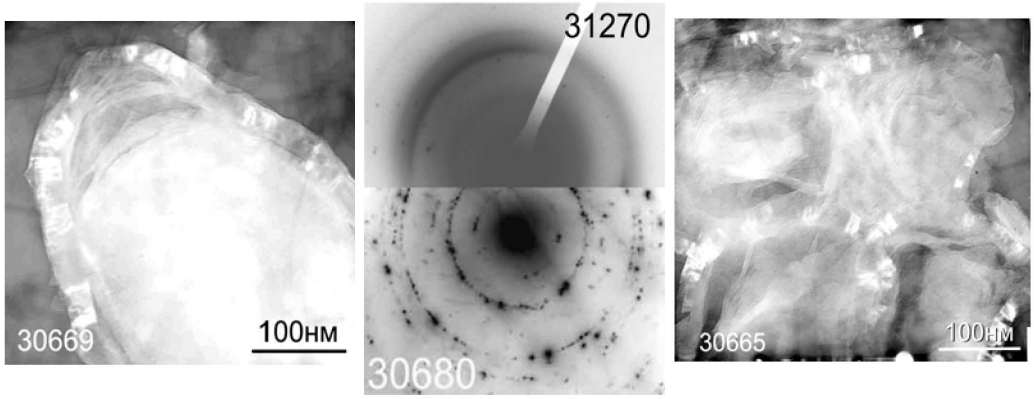
a b c

Figure 2 – TEM-photos, a, b – the negative image (light – a dense site)

The order of formation of the layers obviously looks as follows. Morphologically, a carbonaceous particle with rounded forms consists, as it were, of different clouds (Figure 2a). In this figure, clouds are located in three, in some places four layers. Or, in Figure 2b, a particle in the form of a fragment. The emergence of a dozen flakes can be seen from one edge - when appropriate conditions of future layers come. On the other side, the fragment looks "woolly" because of the apparent overlap of scales on each other. For TEM, spatial resolution is problematic.

In the general case, when electrons are diffracted on a carbon material, standard blurred three rings are formed (Figure 2c). The diffusion and "gravity" of the peak depends on the packing of carbon and on the degree of formation of individual layers of different carbon compounds.

The morphological photograph of the transmission electron microscope (TEM) shows that, probably, the presence of an impurity forms a more dense formation (Figure 3a, dense - light, negative image). In x-ray phase analysis, the same sample does not detect graphite ordering. This is possible when the carbonaceous matter is represented by nanosized particles or their percentage of "graphites" is lower than the sensitivity of the method. For microdiffraction from this particle in transmission electron microscopy (Figure 3b) local amplification and decrease of blurring reflexes (some texturing) are observed. In Figure 3b, (in its upper part) probably as noted above, the beginning of the formation of the "graphite" layer in the predominant carbonaceous matter having two-three-dimensional ordering is depicted [6].



a b c

Figure 3 – TEM-photos

During increase in the concentration of local "graphite" areas (Figure 3c), a graphite-like structure appears (Figure 3b, lower part).

The existence of local regions in the carbon corresponding to "graphites" can serve as an explanation for the blurring of reflections and the deviation of the graphite parameters from the classical value. In practice, in manifestations and deposits, more often there is no graphite in the classical sense, but graphite with broken structure - with slightly different or not manifested by X-ray (XFA) and electron-microscopic (TEM) parameters.

This same circumstance (the formation of local "graphite" areas) explains the existence of a combination in graphene/grafanic layers.

Probably, the formation of graphites occurs as follows. At first, the layers come closer/move away. The distance between atoms of one layer and atoms of another layer changes. Locally there is a connection between atoms (in the dimensions of the nano-region). "Graphite" order appears. In the case that the "graphite" ordering then passes to the entire foil, a graphite structural order is formed.

Therefore, it is also possible to talk about graphane/graphene layers in graphite of natural manifestations. And the fact that it is possible to single out one layer from a graphite package is shown in the works of Novoselov-Geim.

Conclusion. The local "graphite" structure can be connected with the segregation of carbonaceous formations and formed by graphene/graphan layers.

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ГРАФИТ ГРАФАН/ГРАФЕН ТОПТАРЫН БІРІ

Аннотация. Көміртегі бөлшектердің (ТЕМ) электрондық микроскопиямен трансимиссиялық көріністерін, қазақстандық мысалында бұл қабілетті көміртегі көрсетілуге бөлшектің жаңқалану. Жергілікті мінсіз аймақтары "графит" құрылады. Ықтималдық облыстың қабыршақтануды жұмысында Білім беру схемасы келтірілген. Графит пайда болуы мүмкін жергілікті графан/графен бірі "графит" буып-түю мінсіз көміртегі топтары. Морфологиялық әдіспен растау суреттермен берілген және дифракция (ПЭМ). Осылайша пайда болды, мінсіз жасаушысыға углеродистого заттар тағы бір фаза құрылымдық қатары.

Түйін сөздер: көміртегі тектес бөлшектер, жіктелу, жергілікті қаптау.

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ГРАФИТ ИЗ ГРАФАН/ГРАФЕНОВЫХ СЛОЁВ

Аннотация. Работа проводилась на примере углеродных частиц Казахстанских проявлений. Просвечивающей электронной микроскопией (ПЭМ) показано, что углеродные частицы способны расщепляться. В работе показан один из путей формирования графита. Приведена вероятная схема образования области расслоения. Графитовая упаковка может возникать из локальной «графитовой» упорядоченности графан/графеновых углеродных слоёв. Зоны «графитовой» упорядоченности образуются локально. Это подтверждается показанными морфологическими и дифракционными картинами (методом ПЭМ). Таким образом, появилась еще одна фаза упорядоченности углеродистого вещества, образующего структурный ряд.

Ключевые слова: углеродистые частицы, расслоение, локальная упаковка.