ABOUT THE TYPOLOGY OF DIFFUSION

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Maqolada fizika fanidagi "diffuziya" terminini aniqlashtirishga harakat qilingan, uning kimyo va fizika fanlaridagi farqlari ko'rsatib berilgan. Mualliflar diffuziya turlarini tasniflashning o'z variantlarini taklif etganlar.

Kalit so'zlar: *diffuziya, o'zaro kirishuv, molekula, atom, elementar zarra, kirishish chuqurligi*

В статье предпринята попытка конкретизировать термин "диффузия" в физике, показаны его различия в физике и химии. Авторы предлагают свой вариант типологии диффузий.

Ключевые слова*: диффузия, взаимопроникновение, молекула, атом, элементарная частица, глубина проникновения.*

The article makes an attempt to concretize determination of diffusion in physics, shows the basic distinctive features of diffusion studied in physics and chemistry. The authors offer their version of a typology of diffusion.

Key words*: a diffusion, interpenetration, a molecule, an atom, an elementary corpuscle, the depth of penetration*

In various books, textbooks, dictionaries and encyclopedias about physics, diffusion is characterized as "interpenetration of the contiguous substances due to the thermal action of the particles of matter" or "partial distribution of bodies into each other, resulting the complete homogeneity of the system at the beginning of a heterostructural".

Diffusion (from Latin diffusion – dissemination, spreading) - transfer of the particles of different nature due to random thermal action of the molecules (atoms) in single or multicomponent gas or condensed matters. (1.2). We can bring a number of some other definitions.

In all these definitions were noted that one of the main features of diffusion is interpenetration or mutual penetration of substances into each other. As for the question of what exactly the specific substances are, different authors give various answers. Some of them write that it is an interpenetration of bodies, some authors – interpenetration of particles, others write that it is an interpenetration of molecules.

Basing on the fact that scientific terms should be extremely accurate, it seems to us that we should define the limits of the diffusing substances. The definition of the upper and lower boundaries is necessary because physics does not study processes of diffusion, which occur below the lower and above the upper limits of physical objects. About the “upper” and “lower” bounds, we mean dimension of the diffusing elements.

By the dimension bodies can be divided into the following groups: 1) Microparticles (atoms and elementary particles); 2) Molecules; 3) Macroscopic particles. Such a division of the diffusing substances is based on the fact that the diffusion of microparticles, molecules and macroscopic particles have significant differences. So the diffusion of molecules is accompanied by a change of physical features of the elements, the diffusion of microparticles is accompanied by a change of chemical features of the diffusing substances.

Diffusion of the macroscopic particles, including biological and social phenomena requires special consideration. So in the social sciences there are deputes about whether it is possible to separate diffusion as a social type. In the present time, the vast majority of philosophers oppose such allocation. It seems to us that the term “social diffusion” must exist. The fact is that in the society there are many phenomena that could be defined as “ social diffusion”. So interpenetration of vocabulary items of different languages and words can be defined as a social diffusion.

If we analyze the lexical composition of any language, it can be found a large number of words borrowed from other languages. Mutual borrowing helps to develop a language. And as we see, it is a linguistic diffusion which is a type of social diffusion. Similar phenomena is observed in other areas of the society. Basing on this we consider it possible to highlight the social diffusion on a separate series of diffusions. Due to the fact that this issue requires special consideration, we confine ourselves to this.

At this stage of development of science diffusion is mainly studied in the frameworks of physics. But there are some varieties of diffusion which must be studied by the representatives of chemistry, biology and even social sciences. The aim of our study is to determine the boundaries of diffusion processes which are studied in physics.

It seems to us that the most suitable, from the point of view of physics, is definition which states that diffusion is a “mutual penetration of molecules of different substances”. This definition we consider the most suitable in the fact that it indicates the lower limits of object diffusion that are studied. Interpenetration of the particles that are smaller than molecule is beyond the scope of physics. Interpenetration of atoms and its components results changes in the physical and chemical properties. The task of chemistry is to separate this. For instance, chemical reactions are interpenetration of atoms and elementary particles of different chemical elements.

It is fair to say that in chemistry such reactions where occurs interaction of molecules. But this is a special type of interaction and interpenetration which can be a form of chemical diffusion. Thus it can be said that the lower boundaries of the diffusion studied in physics are molecules of interpenetrating substances.

The next task of the science – defining the upper limits, entering into the process of diffusion of objects which are studied in physics. We believe that the lower and upper limits of the physical diffusion are limited by molecules, i.e. it is possible to state that the objects of physics in the study of diffusion is the interpenetration of the molecules of substances.

Now when we have clarified the limits of physical diffusions, we can move on to their characteristics. Physical diffusion takes place in gas, liquids and solids, and can diffuse so particles of foreign substances as own particles (self diffusion)

The fastest diffusion occurs in gases, slowly in liquids, even slower in solids. It is due to the nature of thermal motion the particles in these area.

Diffusion also has a distinctive feature of the direction. This is clearly seem when the diffusion occurs between the materials with different densities’ of molecules. Thus if two substances with different density contact, deegre of their penetration will also be different. Molecules of denser substances penetrate deeper into the less dense material. There appear certain regularity. If the hardness of material A exceeds the hardness of material B, molecules of the substance A will penetrate twice deeper into the material B.

Temperature affects to the hardness of the material and to the depth of interpenetration. If two substances with the same hardness and temperature come into contact the interpenetration of the molecules will be the same. If the temperature differences, a substance having lower temperature will penetrate deeper than molecules of substance with higher melting. This is due to the fact that the heat has a softening effect on the density of a substance.

A further feature of diffusion is the depth of interpenetration. The study of diffusion in physics should look beyond physical phenomena. It seems to us, as was mentioned above, in the study of

diffusion must be engaged and such sciences as chemistry, biology and even social sciences. Now we consider the possibility and necessity of studying diffusion in the chemistry. The question of the social and biological forms of diffusions requires special consideration.

The need to study diffusion in chemistry is that chemical reactions are inherently diffusion. If physics studies diffusion as an interpenetration of molecules, chemistry studies it as an interpenetration and interaction of Atoms, electrons and other elementary particles. Reffering to the example

$H_2O + CH_3COOH \leftrightarrow H_3O^+ + CH_3COO^-$

Hydrogen atoms in the CH_3 group connected to carbon atoms by strong covalent forces. This reaction indicates that the interpenetration of atoms leads to the formation of new substances.

Conclusion:

1) Diffusion is not only the interpenetration of molecules but interpenetration of atoms, electrons and other elementary particles. Interpenetration process of atoms and molecules, electrons and other elementary particles differ from each other.

2) Typology diffusions can be performed on many criteria: on the flow rate, directivity of the process, depth and other parameters. By the depth of flow diffusion can be divided into chemical and physical.

3) Physical form of diffusion is characterized by the interpenetration of molecules, chemical form – by interpenetration and interaction of atoms and elementary particles, formation of new substances, with properties which does not exist in the primary reactants.

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