A STUDY OF PROPERTIES AND CHARACTERISTICS OF POL I MER

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ABSTRACT

The article talks about the role of physics in the modern national economy, production and scientific system. The subject of the physics school curriculum, the methodology of teaching physics, the basis of the professional training of a physics teacher, the content and tasks of the methodology of teaching physics as a science, the methodology of learning the science of physics teaching methodology, the production of the physics teaching methodology history. A number of issues such as

Key words: *pedagogy, professional training, pedagogical methods, lecture, laboratory work, training, teaching, physics methodology, methods, efficiency, experience, lesson, tournament.*

Enter. Now it is difficult to imagine life without polymers. Gadgets, clothing, spare parts and even contact lenses are made from them. And the DNA molecule itself is a polymer. RBC trends revealed what polymers are and how they are made Read more at RBC: What are polymers The word "polymer" comes from the Greek: pollá

(many) and méros (part). Polymers are substances consisting of many monomers (structural units). Polymers can be linear, branched, or branched in structure.

The number of monomer units and the molecular weight of each of them affect the properties of the future material. Read more in RBC: Name of synthetic polymers used in the article: Polyethylene is a thermoplastic polymer of ethylene. Polyurethane - The raw material for this polymer is polyol. It is derived from crude oil. Polyamide is obtained as a result of chemical processing of coal, gas and oil.

Polyvinyl chloride (PVC) is a synthetic thermoplastic composed of chlorine and ethylene. Bakelite is a reaction product of phenol and formaldehyde under pressure at high temperatures. Polystyrene is a material obtained as a result of the polymerization of styrene.

Since the change of the economic mechanism, the global polymer industry has set the direction of deep integration into the international division of labor in the production of polymers and occupies leading positions in a number of fields. For example, in the production of polyolefins (polyethylene, polypropylene). From the point of view of economic efficiency, the polymer business is aimed at obtaining the most promising technologies of the West and placing them in all production points of the world.

Research methodology. Polymethyl methacrylate (Plexiglas) is a light-transmitting and glass-like polymer. Polyester fiber - used as a filler in toys, blankets, pillows, furniture. Polypropylene is a solid obtained by polymerization of propylene (a colorless gas). Polyamides - this group of plastics includes nylon, nylon and anid. Teflon is a polymer containing carbon and fluorine (polytetrafluoroethylene).

Polymer composites are made from two or more components. The polymer acts as a base (matrix). Polyacrylamide (PAA) is a white, odorless polymer. Soluble in water, glacial acetic and lactic acids, and glycerol, but insoluble in ethanol, methanol, and acetone.

Polymer applications Polymers in the oil and gas industry .

Oil and gas are not only a source of fuel for many types of transportation, but also raw materials for chemical production. Many types of polymers are created from petroleum products. The resulting polymers are also used in the extraction process itself. Thus, polyacrylamide (PAA) and its derivatives are used to increase productivity and clean pipelines. This technical water-soluble polymer helps to increase the maximum throughput of the oil pipeline and improves the quality of pumped oil.

Thus, in 2017, students and professors of the National Research Technological University "MISiS" decided to use polyethylene as a substitute for bones, joints and muscles. According to scientists, if the idea comes to fruition, then the useful life of the implant made of this material will be at least 15 years. Economy of innovations .

Innovations in Injury Prevention: The Latest in Sports Medicine

In the automotive industry, automotive companies use at least 100 types of polymer materials in the production of vehicles. Thus, the wheel covers, instrument panel and some parts of the engine are made of polypropylene.

The seats are made of polyurethane, the soles are made of polyethylene. Drive handles, gears, gas tank, battery, fuse boxes contain polyamide. Wires are made of polyvinyl chloride (PVC). This thermoplastic vinyl chloride polymer is familiar to people all over the world. Linoleum and stretch ceilings are usually made from it.

In the food industry, polymers in the food industry must meet certain hygiene requirements. They should not affect the organoleptic properties of products (taste, color, smell), and should not contain toxic components. Polymers are used not only in the production of equipment for the food industry, but also in packaging materials. Equipment. For example, in the canning and dairy industry, the links of conveyor belts are made of polyamides or high-density polyethylene. And to prevent raw materials and semi-finished products from sticking to the surface of the equipment, special polymer coatings are applied to metal structures. polymer packaging. It allows storage of millions of tons of agricultural products and food products in stores. Thus, disposable multilayer films keep food 20% longer without adding preservatives.

Results and its discussion. Properties of polymers Impact resistance.

According to the ability to withstand mechanical stress, polymers are in no way inferior to some metals. Therefore, polymers are used to create car bumpers, protective coatings, etc. Elasticity and elasticity. This property has, for example, natural and synthetic rubber. Therefore, they are used to make car tires, hoses, wire and cable coverings, shoe soles, balloons, etc. reflection Due to this property, special reflective films are created from polymers. Usually they are used to show things in the dark. For example, reflective materials are used in the organization of traffic, in the creation of billboards and banners. Electrical insulation. Polymers are dielectrics (they do not allow electric current to pass through them). They can be used not only in electrical equipment, but also in the production of tool handles for working with electrically conductive parts.

Nucleic acids. Nucleic (DNA) and ribonucleic acids (RNA) contain all information about a person: from diseases to talents. Natural rubber. It is a plastic and viscous polymer found in the sap of rubber plants. Green economy Scientists have found a way to produce vanillin from plastic Synthetic natural polymers were enough for industry until the 19th century.

But over time, due to the lack of resources, the need for other materials arose. So, in 1909, the American chemist Leo Baekeland tried to find a replacement for natural shellac (resin). But in the end, experiments helped him create a material called Bakelite. It was obtained as a result of the reaction of phenol and formaldehyde under pressure at high temperatures. It was with this discovery that the era of synthetic materials began. The creation of new types of polymers began in chemical laboratories. Read more at RBC: Before World War II, several countries (England, Germany, and the United States) began producing synthetic rubber.

At the same time, production of polystyrene, polyvinyl chloride, and polymethyl methacrylate began.

Read more at RBC: How polymers are made Polymers are made in two ways: polymerization and polycondensation. Each of them has its own characteristics. Polymerization is the joining of monomers into chains and held together by chemical

bonds. As a result of polymerization, polystyrene, chloroprene and butadiene rubber, Teflon, polypropylene, polyethylene are produced. "Polymers are formed as a result of the reaction of combining monomers. In simple words, these are beads, where the beads are monomers. When obtaining polymers, the composition does not change. That is, whatever atoms are in the substance remain. Only their number o "changes. And depending on the number of monomers, their properties change", More in RBC:

In the process of polycondensation, in addition to the polymer, a low-molecular substance (water, alcohol, hydrogen chloride) is formed.

In the process of polycondensation, lavsan, polypeptides, phenol-formaldehyde resins are formed. But kapron, for example, can be taken in two ways at the same time. Polymers and Plastics: What's the Difference Often the word "polymer" is used as a synonym for the concept of "plastic". But it is not. Plastic is just one type of polymer. Many types of plastics are synthesized from petroleum or hydrocarbon oil. More than 380 million tons of plastic are produced in the world every year. And every year about 8 million tons of items made of this material enter the World Ocean: bottles, bags, fishing nets. According to environmentalists, it was the plastic manufacturing process that caused the global waste crisis.

Plastics or plastics are materials based on synthetic or natural high molecular compounds. Plastics based on synthetic polymers (Fig. 1) are widely used.

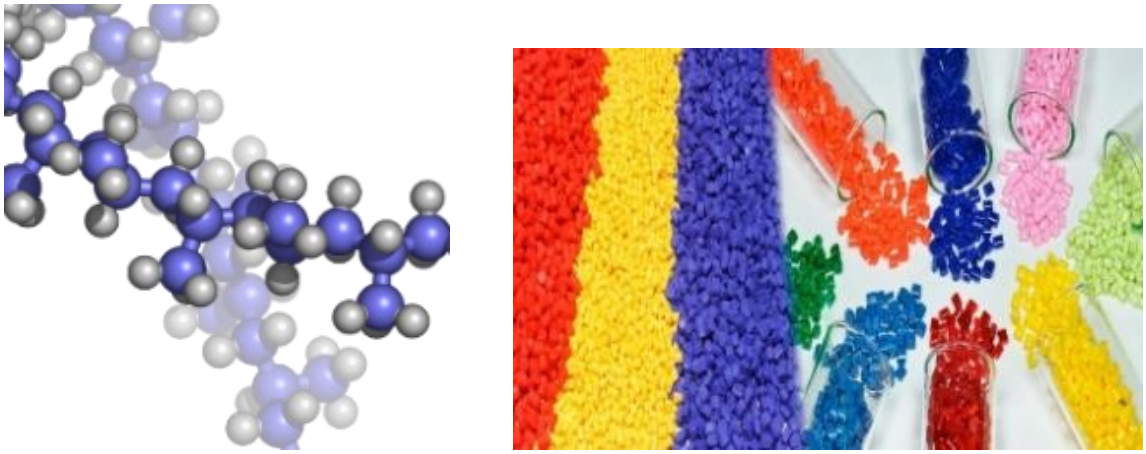


Figure 1 **. a. Plastic** **b. Plastics and properties**

Polymerization (another Greek word, pyomkes - consisting of many parts) is a process of formation of a high molecular substance (polymer) by repeatedly attaching molecules of a low molecular weight substance (monomer, oligomer) to the active centers of a growing polymer molecule. A monomer molecule that is part of a polymer forms a unit called a monomer (structure). The elementary composition (molecular formulas) of monomer and polymer are approximately the same.

Generally, monomers are compounds that contain several bonds or cyclic fragments that can open and form new bonds with other molecules, allowing chain growth.

The process of polymerization is that one monomer is attached to a monomer unit, another monomer is attached to the same unit, and so on. We can consider this process as a random event: the connection occurs with a certain probability, and therefore does not occur with probability, since the sum of the probabilities of opposite events is equal to one [probabilities a result of the swelling theorem. two incompatible events]. Since each subsequent addition occurs independently of the previous ones, the probability of forming a molecule containing monomers is calculated according to the formula.

$$P(n) = \underbrace{p \cdot p \cdot \ldots \cdot p}_{n \text{ раз}} \cdot q = p^n \cdot q = p^n (1-p).$$

Properties of polymers . Special mechanical properties: elasticity - ability to high reversible deformations at a relatively light load (rubbers);

low vitreous fragility and crystalline polymers (plastic, organic glass);

ability of macromolecules orientation under the influence directed mechanical field (when used fiber production and movies).

Properties of polymer solutions : high solution viscosity at low polymer concentration;

Dissolution of the polymer occurs during the swelling phase.

Special chemical properties: the ability to dramatically change his physical state

- mechanical properties under the influence of a small amount of reactive (rubber vulcanization,

leather tanning and etc.).

The special properties of polymers are explained not only by the great molecular weight but and that macromolecules have chains structure and has flexibility.

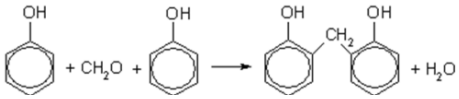
Classification of polymers . According to their chemical composition, all polymers are divided into: organic, organoelement, inorganic. Polymers with organoelements. They include basically chains organic radicals, inorganic atoms (Si, Ti, Al), adaptation with organic radicals. They do not exist in nature. An artificially obtained representative — organosilicon compounds. It should be noted often in technical materials use a combination of different groups of polymers. This composite materials (eg fiberglass). According to the shape of macromolecules, polymers are linear, branched out (special case - star-shaped), ribbon, flat, comb-like, polymer mesh and so on.

Polymers are classified by polarity (effect solubility in different liquids). Polymers with units important polarity is called hydrophilic or polar Polymers with non-polar units - non-polar, hydrophobic. Polymers containing both polar and and Nonpolar units are called amphiphiles. Homopolymers, each unit of which contains both polar, yes and nonpolar large groups, suggested is called an amphiphile homopolymers .

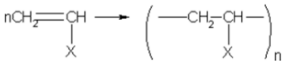
in relation to polymers are split for heating thermoplastic and thermosetting. Thermoplastic polymers (polyethylene, polypropylene, polystyrene) softens when heated, it even dissolves and they harden when cooled. This the process will resume. Thermosetting polymers undergo heat transfer irreversible chemical destruction without dissolution. There are thermosetting polymer molecules non-linear structure obtained by stitching (for example, vulcanization) of chain polymer molecules. Thermoset polymers have higher elastic properties How so in thermoplastics.

Phenol - Formaldehyde resin is a thermoset polymer obtained as a result of the polycondensation reaction of phenol with formaldehyde presence of acids. Phenol-formaldehyde resins are used as a basis for various including composite materials

fillers, hardeners and other components. Of such products materials are durable and have good dielectric properties features.



Polyethylene (Figure 2) (-CH2-CH2-)n is one of the simplest polymers. His molecular weight from 20,000 to 3,000,000 A -depending on method of reception. Polyethylene - transparent with thermoplastic material high chemical resistance, poor thermal conductivity and electricity. It is used for insulation of electric wires transparent films and household items. As a result of polymerization V Asymmetric carbon atoms appear in the main chain, which differs by the connected location X groups with them against the main chains. There are isotactic and syndiotactic and atactic polymers. IN in isotactic polymers, the substituents are strictly on one side OS main chain, in syndiotactic polymers - alternately different the sides of the chain and in an atactic state - chaotically on one side or the other chains. In the first two cases, the polymer is said to have stereoregularity structure. Isotactic polymers have especially valuable physical properties - mechanical properties.



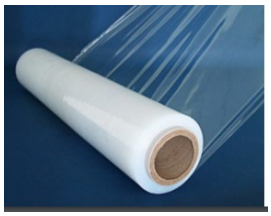


Figure 2. Polyethylene

Polyvinyl (Fig . 3) chloride (PVC, vinyl, polyvinyl chloride, winnol, corvik, sikron, Westolite, Hostalite, Jeon, Sumilite, Lukovil, Nippeon, Helvik, Norvik and others) is a white plastic, thermoplastic polymer vinyl chloride. Polyvinyl chloride (PVC) pipes, sheets, films, polyvinyl chloride fiber, shoe plastic compounds, polyvinyl chloride foam, linoleum, furniture edges, etc. Also The scope of application of PVC is the production of gramophone records, a wide range A series of profiles for the

production of windows and doors, corrugation pipes for electrical insulation of wires and cables.

Polyvinyl has a high chemical composition resistance to mineral oils, alkalis and many types of acids as well o solvents. Not polyvinyl chloride it burns in the air, but at the same time there is low frost resistance (about minus 15 °C). As far as heat resistance plus 65 ° C. Temperature indicators can be easily changed by doing various composite materials content in the necessary conditions. Chemical formula polyvinyl chloride [-CH2-CHCl-]n

Figure 3. Polyvinyl

Rubbers . Natural rubber is natural a high molecular weight unsaturated hydrocarbon composition (C5H8)n, where n = 1000 - 3000. It was determined that it consists of polymer repeats units are 1,4-cis-isoprene and have stereoregular structure.

Butadiene rubber is produced in two forms types: stereoregular and non-stereoregular. Butadiene rubber, stereoregular, in mainly used in the manufacture of tires, which to wear resistance is significantly higher than tires from natural rubber.

Butadiene rubber (Figure 4) nonstereoregular is used to produce, for example, ebonite, alkali and acid resistant rubber. Styrene butadiene rubber is used production of rubber shoes, car tires and conveyor belts, and is characterized by an increase wear resistance.

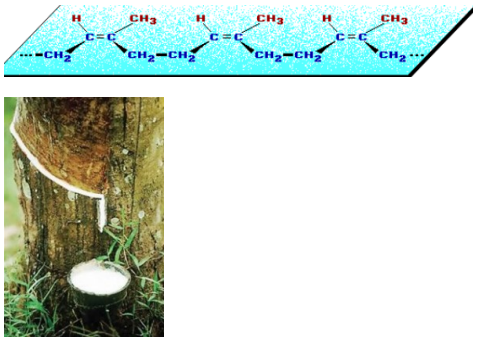


Figure 4. Butadiene rubber

Summary. Thus, polymers are used in all sectors of the economy. Our life cannot be imagined without polymers.

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