STUDY OF THE PROPERTIES OF NON-METALLIC MATERIALS.

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Abstract. The article considers the main factors of studying the properties of non-metallic materials.

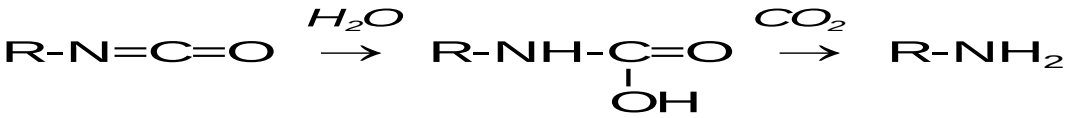
Keywords. Raw material, polyurethane, molecule, macromolecule, crystal, mechanical strength, catalyst, reaction, prepolymer

Introduction. It is known that, depending on the nature and structure of raw materials and components, polyurethanes can be thermoplastic and thermoreactive, and the polymers obtained from them can be plastic, brittle, soft and hard. Linear polyurethanes obtained from low molecular weight glycols have the property of forming fibers. In the process of fiberization due to gravity, macromolecules are oriented, which leads to an increase in the degree of crystallinity and strength of the polymer.

Method. The strength of linear polyurethanes largely depends on the hydrogen bonds that form between the imine and carbonyl groups of neighboring macromolecules. A decrease in such intermolecular hydrogen bonds leads to a decrease in the degree of crystallinity of the polymer and a decrease in its softening temperature and mechanical strength.

The oxygen atoms in the main chain of polyurethanes reduce the melting (softening) temperature of the polymer and improve the solubility of the polymer in organic solvents. At the same time, the presence of oxygen atoms in the chain gives polyurethanes elasticity (flexibility) and facilitates polymer processing. Polyurethanes are poorly water-repellent, cold-resistant, exhibit high adhesion and abrasion resistance. Polyurethanes are mainly used in the production of polyurethane foams.

Polyurethane foams are obtained by reacting di- and polyisocyanates with simple and complex hydroxyl-containing polyesters in the presence of water and a catalyst. Carbon dioxide, which is released as a result of the reaction of isocyanates with water, serves as a blowing agent:



Tertiary amines and organic compounds of zinc are used as catalysts. In addition to the listed components, various substances are added to the foam plastic formula - foam stabilizers, additional blowing agents (for example, freons), dyes, surfactants, and reaction rate regulators.

Polyurethane foams can be divided into two groups: elastic foam plastics based on linear or slightly branched polyesters and rigid foam plastics based on polyesters that form highly branched, densely woven polymers.

The density of foamed polyurethanes is adjusted by changing the amount of water. As the amount of water added to the composition increases, the apparent density of the resulting foam decreases. For example, when obtaining polyurethane foam with an apparent density of 32 kg/m3, only 25% of the isocyanate group reacts with the hydroxyl groups of the polyester, the remaining 75% reacts with water. Due to the occurrence of other types of additional reactions, in addition to urethane bonds, various bonds are formed during the production of polyurethane foam. For example, the primary amino group formed as a result of the reaction of the isocyanate group with water reacts with the isocyanate group as follows.

The reaction results in the formation of substituted urea, which, due to the mobility of hydrogen atoms attached to nitrogen, reacts with isocyanate groups at

high temperatures, leading to partial crosslinking of macromolecules ("urea" crosslinking):

Discussion. In industry, polyurethane foams are obtained in two ways: one-step and two-step methods.

In the one-step method, all components - polyester, water, catalyst, stabilizer, emulsifier, isocyanate - are mixed in a mixing apparatus. Foaming occurs immediately, the foam begins to rise in about 10 seconds and is completed within 1-2 minutes. The foam solidifies in a few hours to a day.

In the two-step or prepolymer method, the polyester is first treated with isocyanate obtained in excess of the required amount. In the second step, water, catalyst, stabilizer, and emulsifier are added to the resulting prepolymer while mixing.

Conclusion. Currently, PPU (polyurethane foam) machalkas are used in the production of seats for cars and tractors in the machine industry.

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