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A METHOD FOR CALCULATING SOME PARAMETERS OF REFRACTORY POLYMERS

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Abstract:
We have already touched on the question of the areas in which polymers are applied. Examples of their importance in science and technology include: use of rubber; antistatic coatings; electromagnetic screens; almost all home appliances cases; transistors; LEDs and others. In the modern world, there are no restrictions on the imagination in the use of polymeric materials.

Keywords: Polymer, molecule, chemical, flame, oxide, structure, reaction, biological, macro, electronics, crys lattices, rubber, plastic.

INTRODUCTION

The fire resistance and thermal stability of polymers should not be confused, as the relationship between these two parameters is not always linear. Resistance to high temperatures does not mean that the substance does not emit flammable gases and does not support a flame. Also: materials with a high melting point are sometimes excellent fuels for a fire, allowing it to disperse quickly in a fire.

How polymers are fire resistant?

Fire resistance is the fire resistance of a material. There are two types of refractory polymers: Self-extinguishing - extinguishes when removed from the fire, but burns slowly in the fire. There are two approaches to modifying the properties of polymers to make them fire resistant: changing the polymerization conditions to change the structure of the substance, or adding special additives and additives. Here are some common methods: Introduction to fire extinguishers. Inert flame-retardant additives are used that do not change the chemical properties, but are incorporated into the structure and stop the flame propagation process. Active additives that change the structure of the substance can also be used. They are more effective in terms of reducing flammability, but can affect other physical and chemical properties of the material. Production of flammable composite materials. The surface of the product can be coated with a non-combustible composition or combined multilayer solutions can be prepared.Increasing the density of the crystal lattice. The denser the molecular groups, the higher the crystallinity, the less prone it is to fire.Increasing heat resistance. Although there are exceptions, the increase in high temperature resistance for most polymers has a positive effect in terms of fire resistance.
In practice, refractory polymers refractory polypropylene are widely used, and in several modifications:
PPs is a material to which a fire-fighting agent is added, as a result of which the high temperature resistance rises to 200 ° C and a temperature of up to 250 ° C is allowed with instantaneous short-term heating.PP-FR- 1 is a refractory material that does not support combustion at all, losing strength and shape at temperatures above 250 ° C due to changes in molecular structure and the introduction of halogens into the composition. These types of polymers are mainly used as high-reliability insulating materials for the electrical industry. They are also used in the manufacture of tanks and vessels designed for high-temperature processes (e.g., chemical reactors and electroplating baths) .Use of fire-resistant additives for heat-resistant plastics "

Application in railway transport

Depending on the intended application, different requirements are placed on the fire resistance, mechanical and electrical properties of fiberglass polymers. Epoxy resins (EP) and unsaturated polyester resins (EPS) used in railway vehicles in Germany shall comply with DIN 5510 Part 2. Small parts shall be tested for fire resistance in accordance with DIN 53438 Parts 1 and 3, with panels and coatings. There will be a perforated gas according to DIN 54837. Depending on the function of the components, they must comply with S3 or S4 fire class and in most cases smoke emission class SR2. It was possible to create an NPS material, in the form of 3 layers of fire-resistant not more than 65% by weight. Add 30% glass fabric. The addition of a fire-resistant 35-part weight results in a material S3 SR2 ST2. Low smoke density is one of the key features that facilitates the use of fiberglass in public transport, as materials through smoke extraction can significantly complicate evacuation. When using aluminum hydroxide and ammonium polyphosphate, the optical density of the smoke is very low during ignition. Materials containing these additives do not emit corrosive hydrogen halides during combustion; when a fire occurs, only traces of nitrogen gases (NOx) are detected. Their level is well below the limits set by the Airbus Industry. ES in the form of composite materials has found application in the manufacture of structural parts. Brominated epoxy resins are used in the aircraft industry for side walls and floor panels inside aircraft. The addition of solid additives to these polymers is limited due to the requirements for mechanical properties. However, the S4, SR2, and ST2 requirements of DIN 5510 can be met by the addition of relatively small amounts of ammonium pyrophosphate.

Application in the electronics industry

The fire resistance of materials used in the construction of electrical equipment is determined by product safety standards. In the U.S., fire safety licenses are issued by Underwriters Laboratories (UL). UL requirements are now accepted worldwide. Depending on the fire resistance requirements, the materials are tested horizontally (UL 94 HB class) or harder vertical (UL 94 V2, V1 or V-0) electrical equipment. can be done by using red phosphorus together with pyrophosphate. The use of red phosphorus is justified, especially in cases where the insulating properties of the material are important. They can be used in the manufacture of electronic devices as well as in wetting and soaking processes. ES is used to produce refractory printed circuit boards and dielectrics. Red phosphorus has been shown to be effective as a halogen-free flame retardant in all types of reinforced and non-reinforced epoxy resins. The epoxy resins studied have virtually no effect on the dielectric properties. Polyurethanes are also used as structural and dielectric materials in the construction of electronic devices. Polyurethanes are flammable and therefore must be alloyed with fire-resistant additives in the manufacture of electrical equipment. In the process of preparing the polymer, aluminum hydroxide can be added to the polyol to make it fire-resistant.

Refractory polymers

Many polymers, such as polyurethanes, polyesters, and epoxy resins, are prone to burning, which is often unacceptable in practice. To prevent this, various additives or halogen polymers are used. Halogenated unsaturated polymers are synthesized by condensation of chlorinated or brominated monomers, such as hexachloroendomethylenetetrahydrophalic acid (HCEMTFA), dibromoneopentyl glycol, or tetrachromophthalic acid. The main disadvantages of such polymers are that when they are burned, they are able to emit corrosive gases that have a detrimental effect on nearby electronics.

Given the high requirements of environmental safety, special attention is paid to halogen-free components: phosphorus compounds and metal hydroxides. The effect of aluminum hydroxide is based on the release of water under the influence of high temperatures, which prevents combustion. To achieve the effect it is necessary to add a large amount of aluminum hydroxide: one part of unsaturated polyester resin to 4 parts by weight. Ammonium pyrophosphate works on a different principle: it produces coal, which together with a glassy layer of pyrophosphates insulates the plastic from oxygen and inhibits the spread of flame. A new promising filler is layered aluminosilicates, the production of which is being developed in Russia. Due to its valuable properties, polymers are used in machinery, textiles, agriculture and medicine, automobiles and shipbuilding, aircraft, and everyday life (textiles and leather goods, tableware, adhesives and varnishes, jewelry and other items). Rubber, fibers, plastics, films and paint coatings are produced on the basis of macromolecular compounds. All tissues of living organisms are macromolecular compounds.

Polymer science

The science of polymers as an independent field of knowledge began to develop at the beginning of World War II and was formed as a whole in the 1950s. The twentieth century in which the role of polymers in the development of technical progress and the vital activity of biological objects was realized. It is closely related to physics, physical, colloidal, and organic chemistry, and can be considered as one of the fundamental foundations of modern molecular biology, where the objects of study are biopolymers.

Polymerization and polycondensation

The reaction of forming a polymer from a monomer is called polymerization. During polymerization, a substance can change from a gaseous or liquid state to a very thick liquid or solid state. The polymerization reaction is not accompanied by the destruction of any low molecular weight additives. In the polymerization process, the polymer and the monomer are characterized by the same elemental composition.The polymerization of double bonded compounds, as a rule, proceeds along the chain mechanism. To initiate a chain reaction, the active particles must appear in the initial inert mass. In chain reactions, a single particle contains thousands of inactive molecules in a reaction and forms a long chain. The main active centers are free radicals and ions. The formation of primary radicals and ions can occur under the influence of heat, light, various ionizing radiation, specially introduced catalysts. location and release of water or other low molecular weight substances from the reaction sphere.

Characteristics of polymers

The most important characteristics of polymers are chemical composition, molecular weight and molecular weight distribution of MWD, degree of branching and flexibility of macromolecules, stereoregularity (see Stereoregular polymers), etc. The properties of polymers depend largely on these characteristics. called For example, a polyethylene molecule (-CH2-CH2-) n CH2 = CH2 consists of n chemical units of ethylene. The molecular weight M of a chemical unit and the product of the degree of polymerization is the molecular weight MM of the macromolecule. Depending on the values of m and n, the molecular weight of polymers can vary in a very wide range from 3,102 to 2,106 units.

Monomer is a low molecular weight starting product; Oligomers are polymers with MM <540, a low molecular weight product of polymerization or polycondensation. The properties of oligomers depend in essence on the molecular weight and, accordingly, the degree of polymerization. The molecular weight of polymers is 5,103 <MM <5,105. Most of the polymer varieties belong to this group. The properties of polymers are less dependent on the number of monomer units in the chain than on oligomers. Extremely high molecular weight polymers have MM> 5,105.

The molecular level describes the chemical structure of macromolecules, which is usually determined by the chemical nature of the monomer units and the types of intermonomer bonds.Unlike ordinary substances, a polymer consists of many macromolecules with different molecular weights. Therefore, polymers are characterized by an average MW value. That is, the polymer is a polymolecular. In this regard, in the description of the physicochemical properties of polymers, the value of their molecular weight is given in a relatively wide range. Thus, for example, values for low-density polyethylene (1.9–4.8) are given. Molecular weight distribution (MWD) reflects the heterogeneity of a polymer in terms of chain size and therefore the molecular weight of the macromolecules that make it up. The closer the MWD is to the unit, the more the dimensions of the polymer molecules are the same.The basic physical parameters of the polymers (strength, thermal conductivity, dilatometric characteristics, characteristic temperatures) are practically independent of molecular weight. The molecular weight of polymers affects the rheological parameters of their solutions, thermal deformation, and a number of operational properties. In addition, it depends significantly on the method of obtaining polymers, i.e. the equipment and technology for their synthesis.Macromolecules are subdivided into linear, schematically defined -A-A-A-A-A-, (e.g., natural rubber) according to their structure; branched, with lateral branches (e.g., amylopectin); and if adjacent macromolecules are cross-linked, reticular or cross-linked (e.g., hardened epoxy resins). Highly cross-linked polymers are insoluble, insoluble, and capable of high elastic deformations. Linear polymers have a unique set of physicochemical and mechanical properties. The most important of these properties are: the ability to form high-strength anisotropic highly oriented fibers and films, the ability to form large, long-term developing back deformations, the ability to swell in a highly elastic state before melting; high viscosity alloys. This set of properties is due to the high molecular weight, chain structure and flexibility of macromolecules. Polymers whose molecules consist of the same monomer units are called homopolymers, for example, polyvinyl chloride, polycaproamide, cellulose. Polymers whose macromolecules contain several types of monomer units are called copolymers. Copolymers in which each type of bond forms a sufficiently long continuous sequence to replace each other in a macromolecule are called block copolymers. possible. Polymers in which each or more stereoisomers of the bond form sufficiently long continuous sequences to replace each other in a single macromolecule are called stereoblock copolymers.

CONCLUSION

It is one of the important auxiliaries used in the synthesis of refractory polymer materials. The addition of a fire-resistant flexible synthesizer increases the fire-resistance properties of polymeric materials, which can lead to burning of materials or delaying the spread of fire. Synthetic materials are fire resistant, self-extinguishing and smoke absorbing.

The performance of different fire retardants is not the same. Flame retardants alone typically have low flame retardant efficiency, a large amount of additive, and affect the physical or mechanical properties of the flame retardant matrix. With the help of fire-resistant synergists, the flame-retardant effect of polymer materials can be significantly improved. The use of fire-resistant coatings in a large number of fire protection methods is currently the most economical, simplest and most effective safety measure.

In fact, the use of synergists for fire-resistant coatings is an important component of their fire-retardant properties, which has a significant impact on the performance of fire-retardant coatings. Fire retardants for fire-resistant coatings are usually organic and inorganic, depending on the type of fire-retardant coating. Among them, organic flame retardant has a flame retardant effect and has little effect on the physical and chemical properties of the paint.

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