PLASTICS, TYPES OF PLASTICS, FIELDS OF USE AND PRODUCTION .

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Abstract. This article provides detailed information about the types of plastics, their properties, areas of use and production. The division of plastics into thermoplastics, thermosetting plastics, elastomers and composite materials, their widespread use in industry, construction, automotive, medicine, electronics and other fields is covered. The process of manufacturing plastics is also explained - the stages of raw material separation, polymerization and polycondensation, modification and molding. The article also highlights the environmental problems of plastics and the importance of their recycling.

Plastics are materials that have become an integral part of modern industry and everyday life. They are widely used due to their lightness, strength, low cost, and adaptability to various conditions. Plastics are used in construction, automotive, medical, electronics, packaging, and many other industries.

This article provides detailed information about the types of plastics, their properties, production processes, and applications in various industries. It also covers the environmental impact of plastics and their recycling.

Plastics are artificial materials made from organic polymers with various additives. They are widely used in industry and everyday life due to their lightness, strength, elasticity, and low cost.

Types of plastics

Plastics are divided into the following main types according to their composition and physical properties:

Plastics that soften when heated and become very plastic, easily deformed, and harden again when cooled and can be softened again are called thermoplastic plastics . Such materials can be transformed from one state to another many times. They dissolve in various solvents. Parts made from these polymers can operate at low temperatures (60 ^{o} 70 ^{o} C), and some can even reach (160 ^{o} 200 ^{o} C) .

1. Thermoplastics – The characteristics of this type of plastic are that it softens with heat and hardens with cooling. Generally, only physical changes are maintained during the recycling process, and its chemical nature is maintained. Most of the resins of this type of plastic are polyaddition. Common thermoplastics include: nitrocellulose plastics, acetate fiber plastics, polyethylene plastics, polypropylene plastics, polystyrene plastics, polyvinyl chloride plastics, etc. For example, our common mineral water bottles, polyethylene bags, etc.

Polyethylene (PE) Polyethylene is a raw material often used to make plastic wrap and plastic bags. Properties: lightweight, elastic, resistant to water and chemicals. Uses: plastic containers, food packaging, sanitary pipes, films. Polyethylene is the most common thermoplastic polymer, characterized by chemical resistance, elasticity and recyclability. It is produced by the polymerization of ethylene monomers obtained from petroleum and natural gas.

Polypropylene (PP). It is a raw material in the production of polypropylene. Propylene is obtained mainly from gases released during oil refining. It is polymerized by propylene, Polypropylene is a white powder that softens at a temperature of 165 ^{0}C.

Films made of polypropylene are completely transparent and have very low gas and vapor permeability. Polypropylene is more resistant to other polymer materials. It is a material with a much higher hardness and a much lower density of 0.9g/ ^{cm3}.

Polypropylene is used to make pipes, various household items. It is used to produce radio and electrical components, and is also used to insulate cables. Synthetic fibers made from polypropylene are superior in strength to nylon and nylon.

Polystyrene . Polystyrene is obtained by polymerizing styrene . The polymerization of styrene can be represented by the following scheme. Polystyrene is a colorless and solid substance with a density of 1.05 g/cm 3. Polystyrenes have properties such as high water resistance, high dielectric strength, and chemical resistance (resistance to acids and alkalis).

It is transparent , easily painted, easy to process , chemically resistant to acids (including hydrochloric acid) and alkalis, and is produced in the form of sheets, rods, and powders. The disadvantages of polystyrene include its low resistance to heat (it can be used in any environment up to 80 $^{\circ}$C) and gasoline, as well as its flammability , cracking, and wear .

Polyvinyl chlorides (PVC) - Represents a high molecular compound and forms the polymerization of vinyl chloride, that is , it has a chlorine compound of 56.8% . The presence of chlorine reduces flammability. With the help of plasticizers, hard and elastic materials based on PVC are obtained. Polyvinyl chlorides are light brown to dark brown materials with good electrical insulation properties and high chemical resistance . They are resistant to petroleum products and alcohol.

Polyvinyl chloride is used to make battery cans, pump and fan parts , water, fuel, and oil pipes , containers (for example, windshield washer reservoirs), moldings , seat covers , and is used to cover bodywork , etc. Film - based materials based on Vinplast are used to insulate wires and preserve engines .

Polyamides. Polyamides (linear polymers) are widespread plastic materials, including nylon, nylon and some others. They are hard, impact-resistant, wear-resistant polymers, liquefy at 150-220°C, and decompose at about 300°C. They are resistant to alkalis and petroleum products , but are not resistant to mineral and organic acids. They lose their strength (wear out) when exposed to the atmosphere for a long time. The coefficient of friction of polyamides is less than 0.05, so self-lubricating materials are made from them. They can be used in places where there is no lubrication , as well as in places where there is lubrication with water and oil .

2. Thermosetting plastics – do not change shape when heated, are durable and heat-resistant.

Epoxy resin

Phenol-formaldehyde resins

Polyurethane

Melamine formaldehyde

3. Elastomers (rubbers) – are stretchable and elastic, and are mainly used as tires, adhesives, and sealing materials. Natural rubber, Neoprene, Silicone rubber, Polyurethane rubber

4. Composite plastics - high-strength materials that contain, in addition to plastic, reinforcing fibers (glass fiber, carbon fiber) or fillers.

Plastics have become an integral part of our daily lives and are used in various industries:

1. Household appliances and consumer products. Tableware (polypropylene, polycarbonate). Packaging for fruits and products (polyethylene, polystyrene)

Furniture, toys and sports equipment

2. Construction and architecture. Sheets, doors and windows (PVC) Insulation materials (polyurethane, styrofoam). Water and sewage pipes

3. Transport and automotive. Car bumpers and interior parts (polypropylene, polycarbonate). Aircraft and ship hulls (composite materials) Tires (synthetic rubber)

4. Medicine and pharmaceuticals. Syringes and droppers (polypropylene, PVC) Prosthetic and orthopedic devices. Biomaterials (silicone, bioplastics)

5. Electronics and electrical engineering. Cable and wire insulation (PVC, silicone) Telephone and computer casings Lamps and lenses (PMMA, polycarbonate)

6. Textile industry. Synthetic fabrics (polyester, nylon) Raincoats and raincoats (PVC, polyurethane)

Plastics recycling

Plastics are synthesized from organic substances derived from petroleum, natural gas, and coal. Their production consists of the following main steps:

1. Raw material separation

Monomers such as ethylene, propylene, and styrene are obtained through oil refining. Some monomers are also extracted from natural gas and coal.

2. Polymerization and polycondensation processes

Polymerization is the process by which small molecules (monomers) combine to form larger molecules (polymers).

For example, polyethylene is obtained from ethylene, and polypropylene from propylene.

Polycondensation is the process by which two or more different monomers combine to form polymers, releasing water or alcohol as a byproduct. For example, polyamides and polyesters.

3. Add modifications and additions

Plasticizers, stabilizers, and coloring agents are added to increase strength, elasticity, or fire resistance.

Conclusion

Plastics are of great importance in modern industry and everyday life, and their types and properties allow them to be used for various purposes. However, the impact of plastics on the environment remains a significant problem. Therefore, recycling and the use of environmentally friendly materials are one of the pressing issues.

Plastics technology is constantly evolving and new types of environmentally friendly bioplastics are being produced. Therefore, reducing and recycling plastic waste will become even more important in the future.

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