

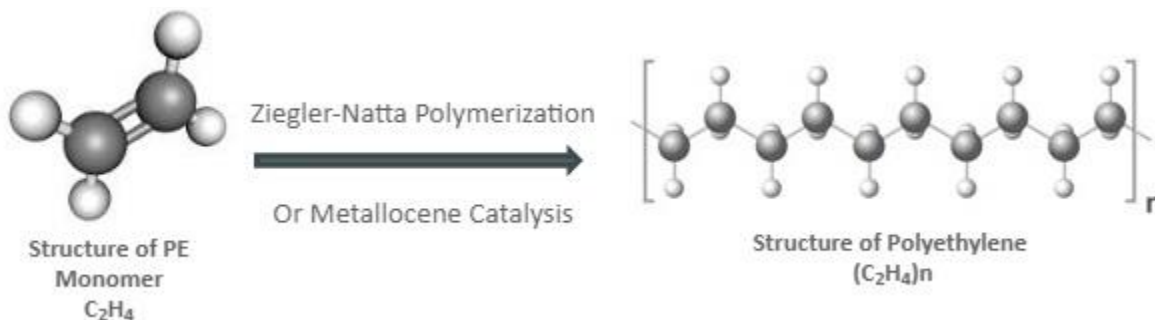


19CH201 ENGINEERING CHEMISTRY FOR CIRCUIT BRANCHES

UNIT-4 HIGH POLYMERS

POLYETHYLENE

Polyethylene is made by addition or radical polymerization of ethylene (olefin) monomers. (Chemical formula of Ethene - C_2H_4). Ziegler-Natta and Metallocene catalysts are used to carry out polymerization of polyethylene.



Common Types of Polyethylene (PE)

PE belongs to polyolefin family of polymers and is classified by its density and branching. The most common types of polyethylene are:

- Branched Versions
 - Low-density polyethylene (LDPE)
 - Linear low-density polyethylene (LLDPE)



- Linear

Versions

- High-density polyethylene (HDPE)
- Ultra-high-molecular-weight polyethylene (UHMWPE)

- Cross-linked polyethylene (PEX or XLPE)

In addition PE is also available in other types such as: (not discussed in detail in this guide)

- Medium-density polyethylene (MDPE)
- Very-low-density polyethylene (VLDPE)
- High-molecular-weight polyethylene (HMWPE)
- Ultra-low-molecular-weight polyethylene (ULMWPE)
- Chlorinated polyethylene (CPE)

Some of the polyethylene suppliers include: Borealis, Celanese Corporation, Dow Chemicals, ExxonMobil Chemical, LyondellBasell, NOVA Chemicals, SABIC. See all Polyethylene Suppliers

Properties of High Density Polyethylene

1. HDPE Melting point: 120-140°C
2. Density of HDPE: 0.93 to 0.97 g/cm³
3. High Density Polyethylene Chemical resistance:
 - Excellent resistance to most solvents
 - Very good resistance to alcohols, dilute acids and alkalis
 - Moderate resistance to oils and greases
 - Poor resistance to hydrocarbons (aliphatic, aromatic, halogenated)
4. Continuous temperature: -50°C to +60°C, Relatively stiff material with useful temperature capabilities
5. Higher tensile strength compared to other forms of polyethylene
6. Low cost polymer with good processability
7. Good low temperature resistance
8. Excellent electrical insulating properties
9. Very low water absorption



10. FDA compliant

Disadvantages of HDPE

- Susceptible to stress cracking
- Lower **stiffness** than polypropylene
- High mold shrinkage
- Poor UV- and low heat resistance
- High-frequency welding and joining impossible

However, weathering resistance of HDPE can be improved by the addition of carbon black or UV absorbing additives. Carbon black also helps to reinforce the material.

Applications of High Density Polyethylene (HDPE)

Excellent combination of properties makes HDPE an ideal material in diverse applications across industries. It can be engineered according to the end use requirements.

Some of the major uses of high density polyethylene include:



HDPE in Packaging and Consumer Good Applications

1. **Packaging Applications** – High Density Polyethylene is used in several packaging applications including crates, trays, bottles for milk and fruit juices, caps for food packaging, jerry cans, drums, industrial bulk containers etc. In such applications HDPE provides the end product a reasonable impact strength.
2. **Consumer Goods** – Low cost and easy processability make HDPE a material of choice in several household/ consumer goods like garbage containers, housewares, ice boxes, toys etc.



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3. **Fibers and Textiles** – Thanks to its high tensile strength, HDPE is widely used in ropes, fishing and sport nets, nets for agricultural use, Industrial and decorative fabrics, etc.