Polyolefine Material Basics

Crude Oil

HDPE (High Density Polyethylen) and **PP (Polypropylen)** are both natural Crude Oil based materials.

Cracker

One fraction of the **Crude Oil** distillation process in a refinery is **Petroleum Naphtha** (gasoline) in liquid form, which if thermical splitted in a cracker, results in the olefins **Ethylen, Propylen and Butylen** in gas form as basic **monomer molecules.**

Polymerization

During **Olefin Polymerization** (lining up cleaned hydrocarbon monomer gas molecules using metal compounds in a catalyst process under different temperatures and pressures to link to long polymer chains) the **Polyolefin's** as Polyethylen and Polypropylen in powder form as basic **polymers** are generated.

The polyolefin properties are preliminary determined by density, molar mass and molar mass distribution.

To achieve the required properties, different temperatures and pressures are applied during catalyst process. To achieve different molecular weights e.g. low pressure of 50 bar at 100° C for HDPE polyolefin with density of 0,941 to 0,965 or high pressure of 3000 bar at 300°C for LDPE polyolefin with density of 0,91 to 0,925 Is applied.

Either melt index, crystalline, cross-linking degree, molecular weight distribution can be regulated in the catalyst process to achieve different polymer grades.

As an option Hexen or Buten gases might be added to the catalyst process to obtain **copolymers** as a basic polymer for advanced polyolefin grades e.g. HDPE pressure pipe grades.

Polymer Families

Due to different polymer chain structures which determine the physical characteristics two main polymer families are defined. **Thermoplastics** as e.g. HDPE,PP,PVC,ABS,PB,PA,PMMA,PS,PET which under defined temperatures can be plasticized and formed into other shape or fusioned without loss of any properties and **Thermosets** as e.g. EP (Epoxy) and PUR (Polyurethane) which cannot be transformed under temperature.

Basic Resin Compound

First compounding (mixing) process to obtain **Basic Polyolefin Resin** (in general of natural color in form of powder or pellets) is to sum up **Additives** and/or **Stabilizers** to the basic polymers to improve the **basic properties** (physical, mechanical, chemical, thermal, electrical and other) as well as **basic processing properties** for product manufacturing.

Final Master Batch Compound

The final compounding (mixing) process results in the **Compound** (also called **Master Batch**) in form of pellets which are used for product manufacturing. **Pellets** may have different forms butt are always in sizes of e.g. lentils.

Now **Special Additives** and /or **Special Stabilizers** are mixed with the basic polyolefin resin to improve to **special properties** required physical, mechanical, chemical, thermal, electrical and other properties as well as **special processing properties** and of course the final **color pigments** for product manufacturing. Packing of the pellets (also called granulate) is available in 25 Kg bags, 1000 Kg big bags or in truck silos to fill up 50000 Kg silos in the factory.

For main product applications and big quantities both compounding processes might be processed in one.

To achieve a very good compound it is essential to treat the basic polymers with care, get uniform dispersion of additives and pigments, to avoid overstabilizing and to care about best connectivity of additives, stabilizers and pigments.

HDPE and PP materials are either called **Thermoplastic Materials** as they can be transformed in a defined hot temperature range without property lost.