

Fillers and reinforcing agents



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A filler is an inert, mineral or vegetable substance added to a basic polymer, making it possible to modify the mechanical, electrical, thermal properties, the surface appearance or to reduce the cost of a material.

The choice of a filler is determined according to the properties sought and must meet a certain number of constraints:

- Compatibility with the matrix: non-toxicity, absence of discolouration or annoying impurities, chemical neutrality and inertia, heat and light stability, low water absorption, no influence on the stability of the polymer or its color.
- Wettability: good distribution of the powder in the matrix or adhesion of the fibers to the matrix.
- Uniformity of quality and grain size.
- Weak abrasive action on the matrix.
- Cost price related to the application.

Fillers improve the mechanical properties of a material. It does not have a negative effect on the processing of the material in particular to obtain a uniform dispersion.

- increase in strength and modulus;
- decrease in elongation and shrinkage;
- increase in thermal stability;
- decrease in thermal expansion;
- modification of rheological properties (flow, thixotropy);
- easier in processing;
- modification of appearance (opacity, color, texture).

To allow their incorporation, the fillers require several chemical and physical characteristics.

In fact, the fillers must not react chemically with the matrix, the adjuvants and the stabilizers. Also, it is necessary to take into consideration, the color and the refractive index, the density, the rate of volatile matter, the dimensions of the particles, the Mohs hardness and the dispersibility.

Generally, spherical fillers have a weak interfacial action with the polymer matrix and behave like inert extenders, which replace by mass effect a certain volume of the polymer.

Thus, cheap powders and flours have an economic interest. These fillers reduce the cost of the molding operation, decrease shrinkage, sometimes improve the mechanical properties of the material (especially in compression).

On the contrary, the fibrous fillers ensure a strong interaction between their surface and the polymer matrix, therefore play (with the exception of carbon black) a reinforcing role: reinforcement of the plastic, increase of the tensile strength, increase of the modulus of elasticity. The improvement of these properties is due to the adhesion between the surface of these particles and the polymer matrix. They are often used as reinforcing agents.

Mineral fillers improve the mechanical properties, increase the modulus of elasticity, increase the density of the material and decrease the shrinkage.