

# **A GUIDE TO** **ADDITIVES IN YOUR INJECTION** **MOLDING MATERIAL**

Almost all commercial plastic materials contain additives such as fillers or reinforcements to improve their processability and end-use performance. This overview of additives can guide you through your material selection process.





The simplest comparison of the relationship between additives and their effects on material properties is the relationship between a cake and its ingredients. If you want a cake to be sweeter, you'd add sugar to the mix, and if you want it fluffier, you'd add an extra egg.

In the same way, resins can be combined, and additives added to them, to ensure your finished parts meet your product's requirements. For example, plastics engineers who want a resin to be stronger would add glass to the material compound. If greater impact resistance is required, they'd add ethylene propylene diene monomer (EPDM), a form of synthetic rubber.

Most additives function as either fillers or reinforcements:

- **Fillers:** Added to only extend the volume of polymer.
- Functional fillers are added to a polymer to improve specific characteristics.
- **Reinforcements:** Added to significantly increase the modulus (stress/strain curve) of the polymer.

Some additives, however, are purely colorants. Apart from lending aesthetic appeal, colorants can make your part user friendly—a differently colored part on your product, for example, can indicate how the product should be used. Colorants also reduce costs. It can help you eliminate the need for painting or coating.

In short, additives help make a parts engineer's material of choice last longer, easier to process, more hygienic, safe for use, and look good. Xcentric experts will be able to source the material you need, and advise you on:

- Which additives are required to produce the results you want.
- Guide you through the formulation and ingredients for the material compound to help you decide.
- Alert you to the industry regulations your additives may need to meet.

Read Xcentric's Material Selection Guide to learn how your choice of plastic impacts costs and timelines. Click [here](#) to download.





# TYPES OF ADDITIVES AND WHAT THEY DO

Additives are chemical compounds combined with a resin to improve the properties and characteristics of the resulting plastic. They offer parts designers the opportunity to customize plastics for their unique purposes, reduce costs, and speed up their product development lifecycle, among others.

Types of Additives	Functions
Impact modifiers	<ul style="list-style-type: none"><li>• Improves shock absorption.</li></ul>
Colorants	<ul style="list-style-type: none"><li>• Adds color for both aesthetic purposes and to reduce or eliminate other cosmetic processes.</li></ul>
Blowing agents/ Foaming agents	<ul style="list-style-type: none"><li>• Weight reduction.</li><li>• Absorbs heat to reduce injection molding cooling times.</li></ul>
Fillers (extenders)	<ul style="list-style-type: none"><li>• Adds bulk to the plastic to reduce material cost.</li><li>• Improves moldability and resin stability.</li><li>• Increases heat deflection temperature.</li><li>• Reduces thermal expansion.</li></ul>
Coupling agents	<ul style="list-style-type: none"><li>• Bonds dissimilar resins.</li></ul>
Lubricants	<ul style="list-style-type: none"><li>• Improves processability by reducing friction and lowering viscosity.</li><li>• Prevents plastic from sticking to the mold to reduce imperfections.</li></ul>
Plasticizers	<ul style="list-style-type: none"><li>• Improves flexibility and durability.</li><li>• Improves stress-strain curve.</li><li>• Lowers processing temperature.</li><li>• Improves melt viscosity.</li></ul>
Flame retardants	<ul style="list-style-type: none"><li>• Reduces flammability.</li></ul>





# THE QUESTION OF COLOR

Selecting a color for your part doesn't just involve picking an accurate shade. There are several factors that influence colorant selection for your injection molding project, including:

- 1 Its chemical compatibility with the plastic material.
- 2 Thermal stability in process and operating conditions.
- 3 Mixability. Consider how well the colorant will disperse within the plastic material, and how well it will suspend within it.
- 4 How it affects the plastic's crystallinity.
- 5 Volume needed to achieve a certain color and how this affects weight.
- 6 How a colorant affects the viscosity of the liquid plastic material. This affects its moldability.
- 7 Its effect on the plastic material—and eventual part's—mechanical properties.
- 8 How well it withstands UV radiation and UV-linked degradation.
- 9 Color retention and migration. Will the color rub off or leach?
- 10 Cost.
- 11 Effect on the environment.
- 12 Toxicity. Does it meet your industry regulations?



# POPULAR ADDITIVES

## TALC

- Good surface finish. Produces a matt surface.
- Dimensional stability.
- Acts as a nucleating agent.

## HOLLOW GLASS BEADS/MICROSPHERES

- Increases tensile strength.
- Increases flexural modulus.
- Increases compression strength.
- Increases heat deflection temperature (HDT).
- Improves dimensional stability.
- Reduces warp, improves screw holding, reduces density.

## LONG GLASS FIBER

- Improves stiffness.
- Results in a higher modulus.
- Improves creep resistance.
- Increases HDT.
- Increases viscosity.

## GLASS FIBER

- Improves chemical stability.
- Improves dimensional stability.
- Reduces shrinkage.
- Improves thermal stability.
- Improves impact strength.

## BARIUM SULFATE (BASO4)

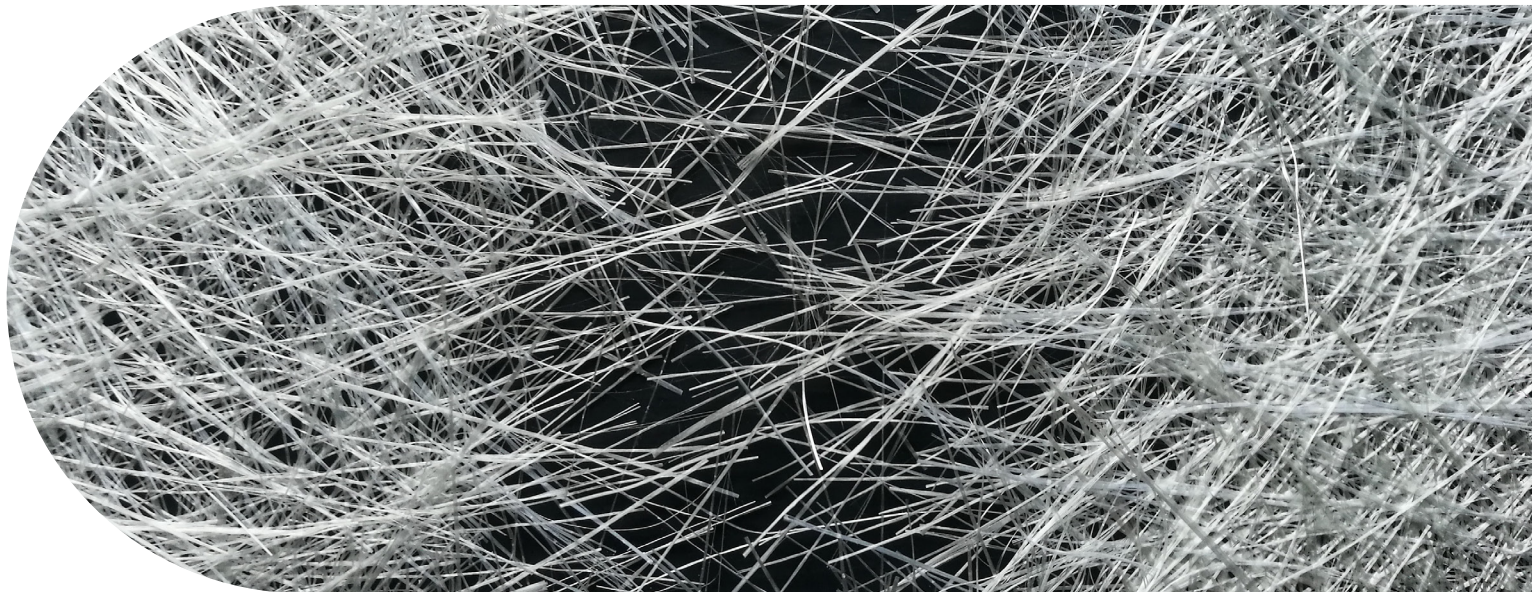
- Improves acid and alkali resistance.
- Increases opacity.

## MOLYBDENUM DISULFIDE (MOS2)

- Widely used as a dry lubricant due to its low friction, and robust capabilities.

## CARBON FIBER

- Improves strength.
- Provides heat and electrical conductivity.
- Enables electric static charge discharge.





## OTHER COMMONLY USED FILLERS AND REINFORCEMENTS

FILLERS
Carbon black
Calcium carbonate
Wollastonite
Kaolin clay
Silica
Stainless steel fibers
Polytetrafluoroethylene (PTFE)

REINFORCEMENTS
Carbon black
Graphite
Ethylene propylene diene monomer (EPDM)
Kevlar
Minerals

### HIGHLIGHT ON EPDM

Ethylene propylene diene monomer (EPDM) is a synthetic elastomer with saturated polymer backbones. It delivers better ozone and heat resistance than unsaturated rubbers like natural rubber and styrene-butadiene rubber (SBR).

EPDM is hugely popular in the automotive industry due to its conformability, impermeability, and ability to cushion and provide elasticity.

Learn more about PEEK, another material that's commonly used in the automotive industry. [Read now.](#)

#### These are some of its applications in the automotive industry:

- System circuit hoses
- Doors, windows, and trunk seals
- Water pumps
- Thermostats
- Heaters
- Oil coolers
- Radiators
- Charge air tubing
- O-rings and gaskets
- Accumulator bladders
- Wire and cable connectors
- Insulators
- Diaphragms
- Weather stripping



#### DID YOU KNOW?

Additives are sometimes used to provide an anti-counterfeiting function. There are additives, such as optical brighteners, which absorb ultraviolet and violet light. These show as a blue glow when seen under higher wavelengths, revealing the authenticity of a part or product.



# ABOUT **XCENTRIC** MOLD & ENGINEERING



Founded in 1996, Xcentric Mold & Engineering is an innovator of on demand digital manufacturing and continues to lead advances in injection molding and rapid prototyping. We know what it takes to deliver a high-quality product on time and on budget.

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