Buyer's Guide

ADDITIVES

For Plastic Injection Molding

PRECISION MOLDED PLASTICS

INTRODUCTION

The plastics used for injection molding come in a variety of types, grades and chemical compositions. Each has its own unique properties and, thus, there are differences in their performance and in how they interact with the world. These resin characteristics are primarily why they are chosen as the base material for a particular part or component (cost being another common consideration). However, while a certain polymer may fit most of the requirements of a particular product, a need might exist for an additional quality the plastic does not contain. That's where additives come in.

Additives for plastic injection molding are substances that are added to and bond with the base resin of a part in order to create a compound with certain modified or additional properties the basic polymer did not have by itself. Generally speaking, additives are used to enhance the appearance or performance of a part; to increase a material's stability or flexibility; to facilitate or optimize production methods; or to extend the service life of a product. Further, additives have varying degrees of compatibility with different plastics (i.e., all additives will not mix well with or create the same qualities in all resins). A plastic additive can be in the form of a liquid, powder or pellet.

One note, by the way, is that plastic injection molding uses two types of materials - thermoplastics and thermosets. Thermoplastics can be melted and reshaped repeatedly, whereas thermosets are irreversibly hardened by curing from a soft solid or viscous liquid. Here, we will focus our attention on thermoplastics.

While there are myriad types of plastic additives, it can be helpful to visualize them in certain categories, although many can be placed into more than one classification, similar to movies fitting into multiple genres. With that being said, most additives fit into at least one of the following ten categories.

LIGHT

Additives associated with light can be used to reflect, diffuse, filter, absorb or resist the harmful or aging effects of natural or other sources of light within various frequencies, wavelengths and amplitudes (e.g., infrared). In other words, these light stabilizers protect a part from photodegradation. Other materials also can be added to polymers to create a part that is laser markable.

WEATHER

Substances often are added to resins to guard against atmospheric conditions. These can include UV rays, radiation (i.e., electromagnetic waves), water, and extreme temperatures. Results can include a reduction in the alteration, fading or degradation of materials.

TEMPERATURE

Heat-related additives (e.g., ceramic fillers and mineral reinforced additives) include those that are fire retardant, flame resistant or that otherwise protect a part from high temperatures. Creating a higher melting temperature generally gives a material greater creep resistance (or a reduction in deformation under stress). Additionally, extreme cold can cause a plastic part to become brittle or crack. Accordingly, plasticizers, which increase the part's flexibility and elasticity, or chemicals designed to lower a material's freezing point (thereby adding to its stability) can be combined with a polymer. Thus, these types of additives can extend the operating temperature range of plastic materials. Also, some substances can increase a part's thermal conductivity.

PROCESSING

Some additives are included in a compound to assist with the injection molding process. These can include blowing agents, foaming agents, and mold release agents. Additionally, lubricants can be added to plastics to help with manufacturing or to increase the desired performance of the part.

CHEMICAL

There are a variety of additives relating to resisting material degradation or contamination caused by other chemical agents, such as antioxidants and antimicrobials. In addition, some substances contribute to the chemical compatibility of parts used in the food and beverage, medical and other industries.

MOISTURE

Some additives are considered or used specifically in relation to water, whether in its liquid or gas (vapor) form. These include moisture resistant or repellent substances, which can provide anti-stain, non-leaching and non-wearing attributes.

PHYSICAL

Many plastic additives are used to modify the physical, structural or mechanical properties of a part. These can be designed to increase the strength, hardness, softness, durability or rigidity of a resin. Alternatively, there are those that enhance a resin's elasticity, flexibility or impact resistance. Also, some additives can be utilized to adjust the mass or weight of a part either up or down.

VISUAL

As a variation on some other categories, certain additives simply affect the appearance or aesthetic characteristics of a plastic part. Probably the most common of these are colorants - in the form of dyes and pigments - which can create a polymer in virtually any hue. In addition to standard colors, there are optical brighteners, those that glow in the dark, or those that create variegated effects (e.g., marbling), shimmer effects (e.g., pearlescent, iridescent), or sparkle effects (e.g., metallic, reflective). There also are thermochromic colorants, where colors change due to an increase or decrease in temperature, and photochromic colors that change with exposure to light. Likewise, some additives can modify the clarity of a part.

BIOPLASTICS

Another relatively modern category of additives are bioplastics, which include biobased and biodegradable resins. Additionally, an assortment of recycled materials, agricultural bioproducts, natural fibers and biocomposites are being added to traditional plastics in order to create a more eco-friendly end product. Bioresins themselves also can serve as the base material for a part.

ELECTRICAL

Certain plastics need an additive to make parts antistatic or, alternatively, to be electrically conductive. In addition, some components have security, traceability or identification requirements, where additives can provide X-ray detectability or radio-frequency identification (RFID), for example.

CONCLUSION

Plastic injection molding utilizes a wide range of polymers with various qualities and characteristics. However, many parts and components have specific requirements their base resins cannot precisely meet by themselves, despite otherwise being the best candidate for a product. When this occurs, substances collectively known as additives can be blended with the basic material to create a compound with modified or added properties. Accordingly, plastic additives can optimize an injection molded part's performance or appearance, and they should be considered when designing and developing a new project.

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