

Types of Plastics – Quick Tips



There are many plastics to choose from when you're planning a manufacturing or fabrication project. To find the best material, start by thinking about the application and environment. What does the plastic part or product need to do? And where will it be doing it? These questions can help you better understand what plastic characteristics you need:

- What range of temperatures does it need to withstand?
- Will it be exposed to chemicals or other harsh conditions?
- Will it be used outdoors and exposed to UV light?
- Is it a structural piece requiring strength and dimensional stability?
- Is it for a bearing-and-wear application requiring a low-friction surface and high wear resistance?
- What is its expected lifespan?
- What kind of load does it need to withstand?

The Polymer Pyramid

The polymer pyramid (also called the plastics pyramid) is a common way of thinking about the range of plastic materials and their general characteristics. These are the three levels of the pyramid, beginning with the base.

Standard plastics, also called **commodity plastics**, are relatively inexpensive and are good for noncritical applications that don't require outstanding thermal or mechanical properties.

Engineering plastics have better thermal or mechanical properties and are generally suitable for bearing-and-wear applications.

Advanced engineering plastics, also called **high-performance plastics**, have even better thermal or mechanical properties and are suitable for more demanding applications. Imidized plastics such as PAI offer the best performance.

The plastics on the left side of the pyramid are amorphous polymers, while those on the right side are semi-crystalline polymers. This distinction is based on whether the molecules that make up the plastic are arranged in a more random or in a more orderly way. The chart below summarizes the general properties of amorphous and semi-crystalline plastics.

Key Characteristics of Amorphous vs. Semi-Crystalline Plastics

Amorphous	Semi-Crystalline
Not suitable for bearing-and-wear applications	Suitable for bearing-and-wear as well as structural applications
Tend to be translucent in thicker sections	Tend to be opaque in thicker sections
Not resistant to fatigue or stress cracking	Resistant to fatigue and stress cracking
Bond well with adhesives and solvents	Bond poorly with adhesives and solvents
Soften at a broad range of temperatures; easy to thermoform	Melt at a distinct melting point; challenging to thermoform
Less chemical resistant	More chemical resistant

Plastic Selection Guide Chart

This table gives information on common applications and characteristics for some of the most widely used plastics.

Plastic Type	Common Uses	Characteristics
Acetal	Precision gears, bearings, bushings, rollers	Available as acetel comopolymer sheets and bars and acetel copolymer rods
		Naturally slippery surface
		Wear resistant
		Easy to machine to close tolerances because they don't expand with exposure to heat or moisture
		Low moisture absorption; better than nylon and other similar materials in high moisture or when submerged
		High strength, stiffness and dimensional stability
Polycarbonate	Machine guards, windows, windshields, safety	For replacing metal parts and other higher performance needs, consider acetal homopolymer sheets and bars or acetal homopolymer rods
		Available as polycarbonate sheets and bars and polycarbonate tubes

	shields, sports equipment, instrument gauge covers, display racks	Stronger and lighter than glass
		Stronger than acrylic
		Excellent impact resistance and good clarity
		Can be clear or colored
UHMW Polyethylene	Food handling solutions, conveyance mechanisms, material handling, packing solutions	Available in UHMW Polyethylene films and rolls , UHMW Polyethylene sheets and bars and UHMW Polyethylene rods .
		Durable, wear-resistant, low-friction surface
		Does not absorb moisture
		Good electrical insulating properties
		Moderate mechanical strength and stiffness
		Excellent machinability
		Some products have an adhesive side for easier application
Nylon		Available in nylon sheets and bars and nylon rods .

		Excellent optical clarity with more durability than glass
		Easily fabricated and thermoformed
		Bonds well with adhesives or solvents
		Suitable for outdoor use and withstands outdoor conditions better than polycarbonate
		Maintains clarity over time
		Cast acrylic is available for easier machining
High-density polyethylene (HDPE)	Plugs, seals and containers	Available in HDPE sheets and bars and HDPE rods
		Excellent moisture resistance
		High chemical resistance against basic solvents, greases, waxes and acids
		Excellent smoothness and anti-adhesive properties
		Marine-grade HDPE is available for use around water
Garolite		Available in garolite sheets and bars and garolite rods and disks

	Medical, aerospace and marine applications	Strong and machinable
		Lightweight
		Electrically insulating
		High dimensional stability
		Highly resistant to moisture
		Flame-retardant garolite is also available
PVC	Valve parts, fittings, piping systems, welded chemical tanks and manifolds	Available in PVC sheets and bars and tubes
		Resistant to chemicals and oxidizing media
		Easily fabricated and thermoformed
		Can be joined with solvents or adhesives
		CPVC is available for additional heat resistance

Other plastics for fabrication and manufacturing include ABS, carbon fiber, HIPS, LDPE, PAI, PEEK, PEI, PETG, polypropylene.

Selecting by Form

You can also select a plastic by thinking about the form as a starting point. Rods, sheets, tubes and films are among the most commonly used shapes, but there are many other plastic forms.

The information contained in this article is intended for general information purposes only and is based on information available as of the initial date of publication. No representation is made that the information or references are complete or remain current. This article is not a substitute for review of current applicable government regulations, industry standards, or other standards specific to your business and/or activities and should not be construed as legal advice or opinion. Readers with specific questions should refer to the applicable standards or consult with an attorney.

Source: Grainger Know How – <https://www.grainger.com/know-how>