# 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 |
| | | For replacing metal parts and other higher performance needs, consider acetal homopolymer sheets and bars or acetal homopolymer rods |
| **Polycarbonate** | Machine guards, windows, windshields, safety | 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 |

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|---|---|---|
| | 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.

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