

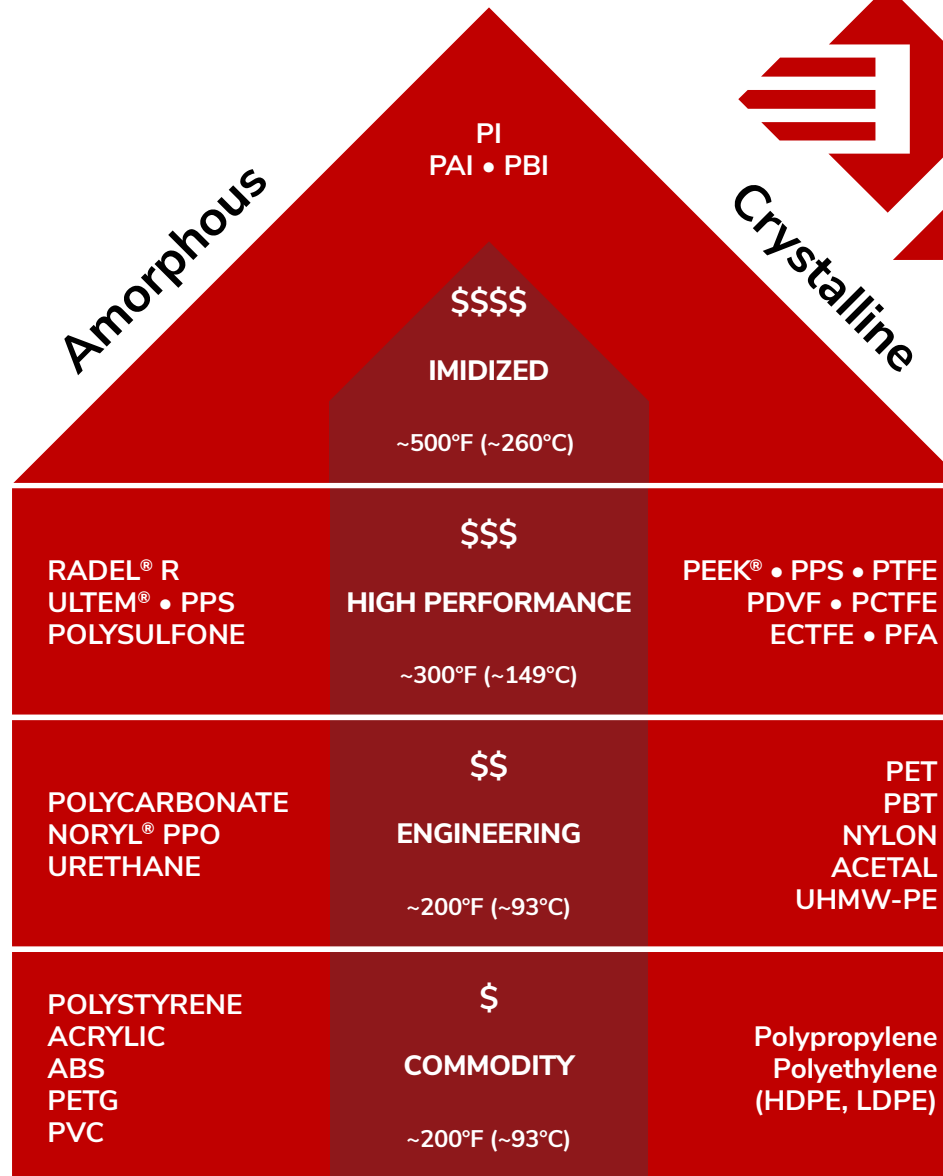
Materials Guide

- Best Physical Properties Above 400°F (204°C)
- Best Temperature Resistance

- Hot Water and Steam Resistant
- High Service Temperatures
- Thermoformability
- High Strength
- Structural

- General Purpose Structural Parts
- Good Dimensional Stability
- Moderate Temperature
- Moderate Strength
- Good Izod Impact
- Easily Fabricated

- Good Machineability
- Low Temperatures
- Good Bondability
- Low Strength



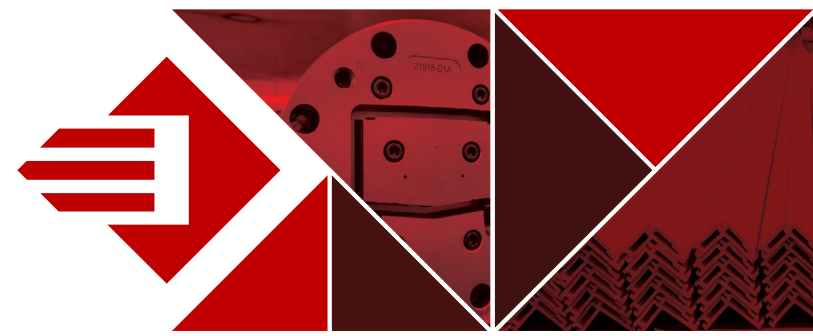
- High Temperature, High Load Bearing and High Wear Capabilities
- Good Chemical Resistance
- Maintains Strength and Stiffness

- High Service Temperatures
- Excellent Chemical Resistance
- High Purity

- General Purpose Bearing and Wear or Structural Parts
- Moderate Strength and Stiffness
- Good Chemical Resistance
- Moderate Temperature

- Low Temperatures
- Low Strength
- Good Chemical Resistance
- Low Moisture Absorption
- Bonds Poorly
- Machines Poorly

This guide represents key material traits and their hierarchy. At its base, you'll find commodity plastics, typically lower in cost and suited for general applications – the reliable workhorses. As you ascend the graphic, materials progress, offering enhanced performance, and culminate at the apex, designed for the most demanding applications where only the best will do. The dark areas show the relative cost and the typical temperature ranges to quickly identify the ideal material family for your project's specific requirements.



Materials Guide

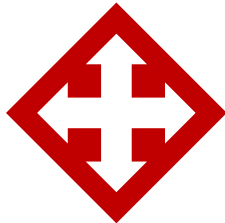
Plastic Material Properties: What Engineers Need to Know

Optimizing plastic selection requires a deep understanding of specific material properties and how they interact. Learn about the critical characteristics that influence a plastic's performance in real-world applications.

1. Yield Strength and Tensile Strength

These two mechanical properties are fundamental to understanding how a plastic material behaves under pulling forces.

- **Yield strength** is the point at which a material begins to deform permanently. Beyond the yield point, the material will not return to its original shape even if the load is removed.



- **Tensile strength** is the maximum stress a material can withstand while being stretched or pulled before breaking.



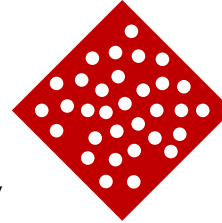
Understanding both is vital: Yield strength defines the safe operating limit for reversible deformation, while tensile strength indicates the material's failure point under tension.

2. Amorphous Versus Crystalline Plastics

The internal molecular structure of a plastic significantly dictates its properties. Plastics are broadly categorized as amorphous or crystalline.

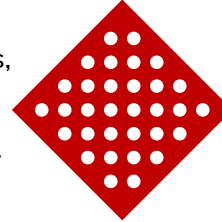
Amorphous Plastics

- Structure: Molecules are randomly arranged, like spaghetti in a bowl.
- Properties: These tend to be transparent, soften gradually over a temperature range, are generally more prone to stress cracking and have lower chemical resistance.
- Applications: Ideal for clear enclosures, lenses, medical devices, food processing equipment and parts requiring tight tolerances.



Crystalline Plastics

- Structure: Molecules have ordered, repeating structures, with both crystalline and amorphous regions.
- Properties: These are typically opaque or translucent, have a sharp melting point, generally possess better chemical resistance and are more resistant to stress cracking.
- Applications: Common in industrial components, pipes, gears, medical devices, food processing equipment and parts requiring durability and chemical resistance.



3. Stress and Temperature

Plastic's mechanical properties are highly sensitive to temperature.

- Increased temperature generally leads to a decrease in strength, stiffness and hardness. Plastics become more flexible and ductile.
- Decreased temperature can lead to an increase in stiffness and strength but often at the expense of ductility, making the material more brittle and prone to fracture on impact.

Engineers must consider the full operational temperature range of a component, not just room temperature, to ensure material selection prevents premature failure.

4. Stress Cracking

The formation of cracks in a plastic may happen when it is subjected to tensile stress in the presence of certain chemicals or environments that would not cause cracking in an unstressed material.

- Cause: A complex interaction between internal or external stress and a chemical agent that attacks the polymer chains.
- Implications: Can lead to unexpected and premature failure of plastic parts, particularly those in contact with cleaning agents, lubricants or certain solvents. Material selection must account for both mechanical and chemical environments.

Our team is ready to help you find the best material fit for your project.