CRYSTALLINE AND AMORPHOUS

Polymers are often described as being EITHER **Crystalline** or **Amorphous**. However, it is more accurate to describe plastics by their "degree of crystallinity." Most polymers are considered semi-crystalline materials with a maximum of 80% crystallinity. Crystallinity is an indicator of how a material will wear, form, or resist chemicals. The more crystalline a material is, the better it will wear. Crystalline materials tend to be less formable.

Amorphous materials have no patterned order between the molecules and can be likened to a plate of spaghetti.

The degree of crystallinity affects many polymeric properties. In turn, other characteristics and processes affect the degree of crystallinity. Molecular weight will affect the crystallinity of polymers. The higher the molecular weight the lower the degree of crystallinity.

Crystallinity is also dependent on the time available for crystallization to occur. Processors can use this to their advantage by quenching and annealing.

QUENCHING limits the formation of crystals by cooling the material prematurely.
ANNEALING encourages the formation of crystals by allowing the material to heat and cool over a long period of time.

Stresses can also result in increased crystallinity as the polymer chains align orienting the crystals. Stresses may result from the manufacturing process, post manufacturing fabrication processes, and application conditions.

Property	**Amorphous**	**Crystalline**
Tensile strength	Lower	Highest
Tensile Modulus	Lower	Highest
Ductility, Elongation	Highest	Lower
Resistance to Creep	Lower	Highest
Maximum use Temp.	Lower	Highest
Chemical Resistance	Lower	Highest
Wear Resistance	Lower	Highest

Amorphous materials offer: Transparency, Formability, Bond ability

Crystalline materials offer: Wear/abrasion resistance, Chemical resistance