

# ***Sharing The Knowledge***

## ***Glossary***

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### ***Addition Polymerization***

Combining or adding simple repeat units to form long chain-like molecules.

### ***Additive***

Materials added in minor amounts to basic resins or compounds to improve a polymer's performance during processing, or tailor a polymer's performance capabilities for end use.

### ***Alignment of Polymer Chains***

Refers to how the polymer chains are ordered. Crystalline resins contain areas of order in which the molecules lie together in relatively straight lines.

### ***Ambient Temperature***

The temperature surrounding an object. The term is often used to describe prevailing room temperature.

### ***Amorphous***

Without structure.

### ***Amorphous Polymers***

A family of polymers characterized by the randomness of entangled polymer chains.

### ***ANSI***

Abbreviation for American National Standards Institute.

### ***Anisotropic Shrinkage***

Shrinkage that is not the same in all directions. Occurs in filled materials due to the restriction of shrinkage along the fiber length which tends to be in the flow direction.

### ***Application***

The act of applying or putting to use. What the molded plastic article will be in its final form.

### ***Arc Resistance***

Measures the time in seconds that an electrical spark can be applied to a material surface before it chars. Once charred, a material is rendered conductive.

### ***Back Pressure***

The resistance placed on the back of a screw in an injection molding machine.

### ***Blending***

Physically combining homopolymers to take advantage of the properties of each to make a new resin product.

### ***Blow Molding***

The process of forming hollow articles by expanding a hot plastic element against the internal surfaces of a mold.

### ***Barrel***

The tubular portion of an extruder in which the screw rotates.

### ***Branching***

The growth of a new polymer chain from an active site on an established chain, in a direction different from that of the original chain.

### ***Branched Polymers***

Polymer chains with additional monomer chains growing off the primary chain.

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| <b><i>Catalyst</i></b>                               | An agent that initiates a chemical reaction but does not become part of the final product. A chemical substance added in minor quantities that markedly speed up polymerization.                                                                                                                       |
| <b><i>Cavity</i></b>                                 | A depression, or a set of matching depressions, in a plastics forming mold which forms the outer surfaces of the molded parts.                                                                                                                                                                         |
| <b><i>Check Ring</i></b>                             | A floating ring that circles the screw at its nozzle and slides back and forth to convert the screw from a "plasticizer" to "injection" in the injection process.                                                                                                                                      |
| <b><i>Clamping Force</i></b>                         | The maximum holding force expressed in tons that a machine is capable of maintaining.                                                                                                                                                                                                                  |
| <b><i>Clamping System</i></b>                        | Part of the injection molding machine that provides the capability to open and close the mold and to hold the mold closed during injection.                                                                                                                                                            |
| <b><i>Coefficient of Thermal Expansion (CTE)</i></b> | Measures how much a material expands and contracts with thermal changes.                                                                                                                                                                                                                               |
| <b><i>Commodity Thermoplastics</i></b>               | A group of thermoplastics which can be differentiated from engineering thermoplastics by a combination of physical properties.                                                                                                                                                                         |
| <b><i>Compression Molding</i></b>                    | A molding process which uses compressive forces to shape a softened thermoplastic sheet. It is also called stamping.                                                                                                                                                                                   |
| <b><i>Compression Ratio</i></b>                      | The relationship between the feed depth and the meter depth of the screw. It indicates the degree to which the core of the screw is tapered and is an important indication of the degree to which the plastic will be compressed as it is conveyed from the feed to the metering section of the screw. |
| <b><i>Compressive Strength</i></b>                   | The maximum squeezing load a material can support before yielding or breaking. It is measured by squeezing a material specimen.                                                                                                                                                                        |
| <b><i>Condensation Hot Air Dryer</i></b>             | A type of dryer that condenses moisture out of the air to lower its dew point but the dew point is still limited by the temperature of the condensation coils.                                                                                                                                         |
| <b><i>Condensation Polymerization</i></b>            | The uniting of two or more monomers with the liberation of water to make a polymer.                                                                                                                                                                                                                    |
| <b><i>Continuous Use Temperature</i></b>             | The recommended temperature at which a material should be used so as to retain its good performance properties over long periods of time.                                                                                                                                                              |
| <b><i>Conversion Process</i></b>                     | The process of converting thermoplastic pellets into parts.                                                                                                                                                                                                                                            |

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| <b><i>Copolymer</i></b>                         | The result of two homopolymers that have chemically reacted to form a new polymer.                                                                                                                                                                            |
| <b><i>Copolymerization</i></b>                  | Chemically combining two homopolymers to form a new resin product.                                                                                                                                                                                            |
| <b><i>C<sub>p</sub></i></b>                     | Abbreviation for heat capacity.                                                                                                                                                                                                                               |
| <b><i>Cross-linking</i></b>                     | Applied to polymer molecules, the setting up of chemical links between the molecular chains.                                                                                                                                                                  |
| <b><i>Crystalline Polymers</i></b>              | A family of polymers characterized by areas of order in which the molecular chains line up and lay tightly together in an otherwise amorphous mass.                                                                                                           |
| <b><i>Crystallization Temperature</i></b>       | The temperature at which a crystalline resin begins to crystallize upon cooling.                                                                                                                                                                              |
| <b><i>Cycle Time</i></b>                        | The time elapsing between a particular point in one cycle of production and the same point in the next cycle. The optimum processing cycle calls for a balance between the filling, cooling, and holding requirements set forth by the material and the part. |
| <b><i>Degradation</i></b>                       | A reduction in the physical properties of polymers from breaking the long chained molecules. It occurs when the resin is heated at too high a temperature or for too long and can result in substandard parts.                                                |
| <b><i>Density</i></b>                           | Mass per unit volume of a substance.                                                                                                                                                                                                                          |
| <b><i>Desiccant Beads</i></b>                   | A component of the desiccant system in the desiccant bed dehumidifying dryer. Tiny ceramic beads that absorb enough moisture from the air to achieve a dew point of -20°F.                                                                                    |
| <b><i>Desiccant Bed Dehumidifying Dryer</i></b> | A type of dryer capable of producing a dew point of -20°F which is necessary to reach the "OK Level." Like other types of dryers, it also heats the air to the specified drying temperature; however, the air is circulated in a closed-loop system.          |
| <b><i>Dew Point</i></b>                         | The temperature at which moisture in the air begins to condense.                                                                                                                                                                                              |
| <b><i>Dielectric Strength</i></b>               | Measures the maximum voltage the material withstands before a track is burned.                                                                                                                                                                                |
| <b><i>Dimensional Stability</i></b>             | The ability of a plastic part to retain the precise shape in which it was molded.                                                                                                                                                                             |
| <b><i>Dissociate</i></b>                        | Break apart. Occurs to crystalline regions when a crystalline polymer is heated above its melting point ( $T_M$ ).                                                                                                                                            |

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| <b>Draft</b>                             | The angling or tapering of part surfaces that are parallel to the <del>parting</del> line <i>of draw</i> for easier part removal.                                                                            |
| <b>Ductility</b>                         | A material's ability to absorb impact.                                                                                                                                                                       |
| <b>Durometer</b>                         | An instrument used for measuring the hardness of a material.                                                                                                                                                 |
| <b>Elastomer</b>                         | A material which at room temperature can be stretched repeatedly to at least twice its original length and, upon immediate release of the stress, will return with force to its approximate original length. |
| <b>Electrical Performance</b>            | Measures how a material responds when exposed to electrical currents and its ability to perform under electrical stress.                                                                                     |
| <b>Electrical Properties</b>             | Three electrical properties that are important when selecting a material are dielectric strength, volume resistivity and arc resistance.                                                                     |
| <b>Elongation to Break</b>               | The degree to deformation at which the material will break.                                                                                                                                                  |
| <b>Endothermic</b>                       | The thermal transition when polymers take in heat.                                                                                                                                                           |
| <b>Engineering Design Database (EDD)</b> | A GE Plastics database which contains graphical data describing a material through its useful performance ranges in terms of stress and strain.                                                              |
| <b>Engineering Thermoplastics</b>        | A group of thermoplastics generally considered as high performance materials and are differentiated from commodity thermoplastics in this respect.                                                           |
| <b>Exothermic</b>                        | The thermal transition when polymers give off heat.                                                                                                                                                          |
| <b>Extrudate</b>                         | The product or material delivered from an extruder; for example, film, pipe, profiles.                                                                                                                       |
| <b>Extruder</b>                          | A machine for producing more or less continuous lengths of plastics sections such as rods, sheets, tubes, and profiles.                                                                                      |
| <b>Extrusion</b>                         | The process of forming continuous shapes by forcing a molten plastic material through a die.                                                                                                                 |
| <b>Falling Dart Test</b>                 | Measures the ability of a material to resist breaking when struck on the surface. Typical names for the test are Gardner Impact and Dynatup Impact.                                                          |
| <b>Fixtured Shrinkage</b>                | A secondary operation to allow post mold crystallization. Parts are reheated above $T_c$ and critical dimensions are held during crystallization to maintain part tolerances.                                |

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### ***Flame Retardant***

An additive that minimizes the chance of a material igniting from exposure to high temperatures, a spark, or an open flame.

### ***Flexural Strength***

The maximum bending load a material can support before breaking or yielding. It is measured by bending a test bar.

### ***Flight Depth***

The distance from the edge of a flight to the core of the screw. The flight depth of an injection molding screw is greater at the narrower feed section than at the wider metering section.

### ***Foam Molding***

A variation of injection molding in which the thermoplastic is foamed during the injection process.

### ***Forming***

A general term encompassing processes in which the shape of plastics pieces such as sheets, rods or tubes are changed to a desired shape.

### ***Fracture***

A material's failure to absorb impact.

### ***Free Shrinkage***

Allowing a part with no critical dimensions to shrink freely during post mold crystallization.

### ***Gate***

In injection molding the channel through which the molten resin flows from the runner into the cavity.

### ***Glass Transition Temperature ( $T_g$ )***

The temperature at which the material turns rubbery upon heating and glassy upon cooling.

### ***Gussets***

Reinforcement structures used to reinforce the part wall and structural supports without increasing wall thickness.

### ***Hardness***

A measure of a material's surface stiffness or resistance to indentation.

### ***Heat Capacity ( $C_p$ )***

The energy required to heat (in calories) one gram of material one degree centigrade.

### ***Heat Capacity Trace***

Provides a blueprint for polymer heating performance by indicating: (1) at what temperatures the material characteristics change, (2) at what temperature the material can be processed and (3) the amount of heat required to process the material.

### ***Heat Deflection Temperature (HDT)***

The temperature at which a material shows significant deformation under load: 1/100 inches or 10 mils. It is usually reported under a high stress of 264 psi and under a low stress of 66 psi.

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### ***Heat of Crystallization ( $\Delta H_c$ )***

The amount of energy that is given off as the polymer builds crystallinity on cooling.

### ***Heat of Fusion ( $\Delta H_f$ )***

The amount of heat needed to melt a crystalline structure (calories per gram or BTU's per pound).

### ***High Voltage Arc Track Rate***

An Underwriters Laboratories (UL) rating that measures how quickly an electrical track can be drawn on the surface of a material. The test measures the tendency of a material to continue charring once charred.

### ***Hollow Boss***

A protuberance provided on a part to facilitate part assembly and for bearing supports and spacers in the part, coring bosses and supporting them with gussets. Minimize high molded-in stress or defect due to uneven shrinkage and strengthens them to withstand mechanical assembly.

### ***Homopolymer***

A polymer that is formed by the polymerization of a single monomer.

### ***Hoop Stress***

The circumferential stress in a material or cylindrical form subjected to internal or external pressure.

### ***Hopper***

In extrusion or injection molding the container holding a supply molding material to be fed to the screw.

### ***Hopper Dryer***

A method of drying resins preferable for longer runs. The three types are hot air dryers, condensation dryers and desiccant bed dehumidifying dryers.

### ***Hot Air Dryer***

A type of dryer that operates by heating the air, thus decreasing the relative humidity but doesn't lower the dew point.

### ***Humidity***

The moisture in the air.

### ***Hydrolysis***

The splitting of a molecule with the addition of water in the presence of heat and pressure, as in processing.

### ***Hygroscopic***

Readily absorbs moisture.

### ***Impact Modification***

A means of modifying a polymer to increase the impact resistance.

### ***Impact Modifier***

A material such as rubber or an elastomer or some plastics with excellent impact resistance, which is blended with a resin to improve its impact resistance. The impact modifier usually has a glass transition temperature ( $T_g$ ) that is well below room temperature.

### ***Impact Resistance***

A material's ability to absorb a great amount of energy before breaking.

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### ***Impact Strength***

The amount of energy required to break a material. Falling Dart and Izod Impact are two popular tests that attempt to quantify a material's ability to withstand impact.

### ***Injection Molding***

A process of mass producing intricate, high performance, high tolerance parts with very little secondary labor and minimal waste. The material is fed from a hopper to a heated chamber where the material is softened, and then forced by a screw into a mold. Pressure is maintained until the mass has hardened sufficiently for removal from the mold.

### ***Isotropic Shrinkage***

Shrinkage that occurs the same in all directions and with unfilled materials.

### ***Izod Impact Test***

Measures the ability of a material to resist breaking when notches are present. A material specimen with a notch which simulates an actual part angle, indentation, or corner is compared with an unnotched material specimen.

### ***Karl Fischer Titration Test***

A quantitative means of accurately determining the moisture level in the pellets as a percentage by weight.

### ***Length/Diameter (L/D)***

Describes the relationship between the length of the screw and its diameter. An L/D of 20:1 is suggested to ensure enough residence time for thorough mixing without adding excessive mechanical energy.

### ***Mechanical Property***

Properties of plastics which are classified as mechanical include modulus, strength, impact resistance, hardness and elongation.

### ***Melt Air Shot***

A sample of the melt when taken on cycle under representative molding conditions will indicate the actual temperature of the melt.

### ***Melting Point ( $T_m$ )***

The temperature at which the crystalline regions break apart and begin to flow.

### ***Miscibility***

The tendency or capacity of the parent homopolymers to dissolve in each other with ease.

### ***Modulus***

Stiffness, a material's resistance to deformation under load.

### ***Molded-in Stress***

Stress that has been "built into" the part during processing. A part with high molded-in stress will have less available strength in application and therefore may fail at a lower load.

### ***Mold Shrinkage***

The amount of material shrinkage in the mold must be accommodated for in the tooling design and is reported in inches/inch, mils/inch, or as a percentage.

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| <b><i>Molecule</i></b>             | The smallest unit of a substance which can exist by itself and retain all of the properties of the original substance. Molecules are composed of one or more atoms.                                                                                        |
| <b><i>Molecular Weight</i></b>     | The weight of a molecule that may be calculated as the sum of the atomic weights of its constituent atoms.                                                                                                                                                 |
| <b><i>Monomer</i></b>              | A relatively simple compound, usually containing carbon and of low molecular weight, which can react to form a polymer by combining with itself or with other similar molecules or compounds.                                                              |
| <b><i>Morphology</i></b>           | Refers to the structure of the polymer material.                                                                                                                                                                                                           |
| <b><i>Multiple-phase Blend</i></b> | A type of polymer modification in which the parent homopolymers are not miscible in each other and each maintains a distinct phase (distinct area) in melt and solid states. This is a physical combination.                                               |
| <b><i>Oxygen Index</i></b>         | Measures the amount of oxygen required for a material to support combustion.                                                                                                                                                                               |
| <b><i>"OK Level"</i></b>           | A coined term that refers to the recommended moisture level to which a given resin must be dried before processing to product parts with good surface appearance and good property retention.                                                              |
| <b><i>Oven Dryer</i></b>           | A method of drying resins, preferable for long runs, which allows for continuous drying.                                                                                                                                                                   |
| <b><i>Parison</i></b>              | A hollow tube of softened plastic used in the conversion process of blow molding.                                                                                                                                                                          |
| <b><i>Plasticize</i></b>           | To render a material softer, more flexible and/or more moldable. A combination of electrical and mechanical heat energy is used to soften the pellets until they flow in extrusion and injection molding.                                                  |
| <b><i>Plastics</i></b>             | A material that contains as an essential ingredient one or more organic polymeric substances of large molecular weight, is solid in its finished state, and, at some stage in its manufacture or processing into finished articles, can be shaped by flow. |
| <b><i>Polymer</i></b>              | A chemical compound formed by many small molecular units together to form a large, chain-like molecule.                                                                                                                                                    |
| <b><i>Polymerization</i></b>       | A chemical reaction in which two or more small molecules combine to form large molecules that contain repeating structural units of the original molecules.                                                                                                |

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### ***Pressure Forming***

A variation on compression molding. The softened sheet is placed over the mold and the edges sealed. Gaseous or fluid pressure forces the sheet to form to the contours of the mold.

### ***Processing Data Sheets***

Contain processing rules suggested by the material supplier for each resin.

### ***Processing Rules***

Suggested rules for processing each resin.

### ***Product Data Sheets***

Report standardized test results for how each resin performs under one distinct set of conditions and variables.

### ***Profile Extrusion***

A conversion process used to form uniform cross sections of infinite length.

### ***Properties***

The characteristics of a material that indicate how well it will perform in a variety of applications. Properties are used to compare and select thermoplastic materials.

### ***Property Loss***

A reduction in how well the material will perform caused by shortening the chain molecules thereby reducing the molecular weight.

### ***Purging***

In extrusion or injection molding, the cleaning of one color or type of material from the machine by forcing it out with the new color or material to be used in subsequent production, or with another compatible purging material.

### ***Pyrometer***

A needle type instrument used to measure the temperature of a melt air shot.

### ***Reciprocating Screw***

A combination melting, softening and injection unit in an injection molding machine.

### ***Regrind***

Waste material such as sprues, runners, excess parison material and reject parts from injection molding, blow molding and extrusion, which has been reclaimed by shredding or granulating. Regrind is usually mixed with virgin compound at a predetermined percentage for remolding.

### ***Relative Humidity***

The percent of moisture in the air relative to the greatest amount the air can hold at a given temperature.

### ***Resins***

Any of various materials made from polymers or plastics.

### ***Reverse Temperature Profile***

One method for reducing mechanical heating by changing the temperature profile on the barrel so that it decreases incrementally from the back of the barrel to the nozzle. This reduces the viscosity of the melt sooner which lowers the amount of mechanical heating in the barrel.

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| <b><i>Rheology</i></b>                  | The study of flow.                                                                                                                                                                           |
| <b><i>Ribs</i></b>                      | Reinforcement structures in a part used to increase the stiffness and load carrying capacity of the part.                                                                                    |
| <b><i>Rigid Reinforcement</i></b>       | An extremely stiff material such as glass, carbon fibers, or minerals which is blended with the resin to give it improved stiffness and strength.                                            |
| <b><i>Runner</i></b>                    | In an injection mold, the feed channel, usually of circular cross section, that connects the sprue with the cavity gate. The term is also used for the plastic piece formed in this channel. |
| <b><i>Screw, Feed Section</i></b>       | In injection molding, the initial portion of a screw which picks up pellets and carries them forward.                                                                                        |
| <b><i>Screw, Metering Section</i></b>   | Shallow end of screw which does final plasticizing of the melt in injection molding.                                                                                                         |
| <b><i>Screw, Transition Section</i></b> | Central portion of screw with reduced channel depth which compresses the plastic, eliminating the air between the pellets and heating and molting them.                                      |
| <b><i>Sheet Extrusion</i></b>           | The process of extruding plastic through a wide die to form a sheet and then pulled through rolls to support and polish the sheet.                                                           |
| <b><i>Shot</i></b>                      | One complete cycle of a molding machine.                                                                                                                                                     |
| <b><i>Shrinkage</i></b>                 | A volume reduction of polymers that occurs during cooling due to a reduction in space between the molecules.                                                                                 |
| <b><i>Simultaneous Engineering</i></b>  | The process which integrates each area of the product development cycle including the design engineer, the mold maker, the processor and the material supplier at the product's inception.   |
| <b><i>Single-phase Blend</i></b>        | A type of polymer modification in which two parent homopolymers are soluble in each other. This is a physical combination.                                                                   |
| <b><i>Sink Mark</i></b>                 | A void on the surface of the part resulting from an outside wall yielding to the still shrinking interior mass.                                                                              |
| <b><i>Snap Fits</i></b>                 | A component used to facilitate part assembly and should be flat, thin and long.                                                                                                              |
| <b><i>Solubility</i></b>                | The tendency or capacity of the parent homopolymers to dissolve in each other with ease.                                                                                                     |

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| <b><i>Specific Gravity</i></b>                          | The density of the material divided by the density of water at the same temperature. It provides a more accurate means of comparing material costs because plastic parts are sold by volume, not weight.                                                                                                                                                                                                                |
| <b><i>Specific Heat Capacity (<math>C_p</math>)</i></b> | The energy in calories required to heat one gram of material one degree centigrade. It is expressed in calories per gram per degree centigrade (cal/gram/°C).                                                                                                                                                                                                                                                           |
| <b><i>Spherulites</i></b>                               | Regions where the polymer chains have aggregated into spheres.                                                                                                                                                                                                                                                                                                                                                          |
| <b><i>Splay Marks</i></b>                               | Scars or surface defects on injection molded parts.                                                                                                                                                                                                                                                                                                                                                                     |
| <b><i>Sprues</i></b>                                    | In an injection mold, the main feed channel that connects the mold filling orifice with the runners leading to each cavity gate.                                                                                                                                                                                                                                                                                        |
| <b><i>Stabilizer</i></b>                                | An additive used to inhibit degradation of a polymer which may be caused by oxygen, light, heat, or water.                                                                                                                                                                                                                                                                                                              |
| <b><i>Stamping</i></b>                                  | A common term for compression molding, a process which uses compressive forces to shape a softened thermoplastic sheet.                                                                                                                                                                                                                                                                                                 |
| <b><i>Stiffness</i></b>                                 | Load bearing capability without deflection.                                                                                                                                                                                                                                                                                                                                                                             |
| <b><i>Strain</i></b>                                    | Material deflection.                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b><i>Strength</i></b>                                  | The maximum load a material withstands before breaking or yielding.                                                                                                                                                                                                                                                                                                                                                     |
| <b><i>Stress</i></b>                                    | The force producing or tending to produce deformation in a body measured by the force applied per unit area.                                                                                                                                                                                                                                                                                                            |
| <b><i>Stress-strain Curve</i></b>                       | The curve plotting the applied stress on a test specimen in tension versus the corresponding strain.                                                                                                                                                                                                                                                                                                                    |
| <b><math>T_c</math></b>                                 | Abbreviation for crystallization temperature.                                                                                                                                                                                                                                                                                                                                                                           |
| <b><i>Tensile Bar</i></b>                               | Used to test tensile strength of a material. Material is molded into a tensile bar. As the bar is pulled the material shows deformation until it finally yields and is no longer able to recover. The material will then continue to deform under the applied stress until it finally breaks. Ultimate elongation measures how far the material will extend before breaking as a percentage beyond its original length. |
| <b><i>Tensile Elongation</i></b>                        | The maximum length a material extends before breaking.                                                                                                                                                                                                                                                                                                                                                                  |

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### ***Tensile Strength***

The maximum pulling load a material can support before yielding or breaking.

### ***T<sub>g</sub>***

Abbreviation for glass transition temperature.

### ***Thermal Conductivity***

Measures the rate at which heat is transferred.

### ***Thermal Expansion (CTE)***

The tendency of a plastic to expand in the heat and contract in the cold.

### ***Thermal Performance***

Measures how a material responds to changing temperatures, and its ability to perform at different temperatures.

### ***Thermal Properties***

Three thermal properties that are important when selecting and processing a material are heat deflection temperature (HDT), thermal conductivity, and coefficient of thermal expansion (CTE).

### ***Thermoforming***

The molding process of forming a thermoplastic sheet into a three dimensional shape by clamping the sheet in a frame, heating it until soft and flowable, then applying different pressure to make the sheet conform to the shape of a mold or die positioned below the frame. It is a low pressure process that is easily automated and incurs relatively low tooling costs.

### ***Thermoplastics***

A family of polymers characterized by its ability to be reprocessed.

### ***Thermosets***

A family of polymers characterized by a high degree of cross-linked chains which undergo a chemical process when heated. Thermoset processing is irreversible.

### ***T<sub>m</sub>***

Abbreviation for melting point.

### ***Tool***

In injection molding, the term sometimes used to describe the mold.

### ***Tomasetti Volatile Indicator (TVI)***

A means of determining if a resin is dry enough for processing.

### ***UL***

Abbreviation for Underwriters Laboratories, the nonprofit safety testing organization.

### ***UL Continuous Use Temperature***

The highest constant temperature at which a material will survive relative to the application requirements.

### ***UL Flammability***

Ratings given to materials after undergoing several tests to describe a material's flammability.

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### ***UL Properties***

Underwriters Laboratory certifies the results of several tests of a material's properties which include: oxygen index, flammability, high voltage arc track rate, and continuous use temperature.

### ***Ultimate Elongation***

The maximum length a material will extend before breaking.

### ***Vacuum Forming***

A method of forming plastic sheets or films into three dimensional shapes, in which the plastic sheet is clamped in a frame suspended above a mold, heated until it becomes softened, drawn down into contact with the mold by means of a vacuum. Atmospheric pressure forces the sheet to form to the contours of the mold.

### ***Viscosity***

Resistance to flow.

### ***Void***

In a solid plastic, an unfilled space.

### ***Warpage***

Distortion caused by nonuniform change of internal stresses.

### ***Weld Line***

The line in a part which results when two flow fronts meet and "knit." The weld line is an area of weakness and should be located in a low stress portion of the part.

### ***Yield Point***

In tensile testing, yield point is the first point on the stress-strain curve at which an increase in strain occurs without an increase in stress.

### ***Yield Stress***

The maximum stress that a material can support without breaking. At this point, the material will not return to its initial orientation, even after the load is removed.