Appendix D: Glossary

ABS (Acrylonitrile-Butadiene-Styrene) A family of thermoplastics based on these three compounds. ABS resins are rigid, hard, tough, and not brittle. This family of plastics is used to produce durable goods products such as appliances and automotive parts.

Acrylic A family of resins formed from methacrylic acid and known for their optical clarity. Widely used in lighting fixtures because they are slow burning or may be made self extinguishing.

Additive A substance added to a basic resin to alter the physical or chemical properties of the resin.

Air Classification The process of passing feed material through or past an air stream at a certain velocity to remove contaminants. The process generally works best with a process stream of dichotomous masses (or densities).

Blow-Molding A method of fabrication in which a parison is forced into the shape of a mold cavity by interval gas pressure.

Coefficient of Thermal Expansion The fractional change in length of a material for a unit change in temperature.

Coextrusion The process of extruding two or more materials through a single die so that the material bonds together at the mating surface.

Colorant A dye or pigment added to a resin to impart color to the plastic.

Compressive Modulus The ratio of compressive stress to compressive strain below the proportional limit. Theoretically equal to the Young's Modulus determined from tensile tests.

Compressive Strength The maximum load sustained by a test specimen in a compressive test divided by the area of the specimen.

Copolymer Typically a polymer of two chemically distinct monomers.

Dewatering Centrifuges and presses are used to remove excess water from plastic particles.

Drying Particles are dried in mechanical and thermal driers to a final moisture content of typically less than 5%.

Elastic Limit The greatest stress which a material is capable of developing without any permanent strain remaining upon complete release of the stress.

Electrostatic Precipitation Primarily aluminum particles from PET beverage bottle caps (and other metals, if present) are passed through an electric field created and collected on plates because of the charge imposed on the particle.

EPM/EPDM (Ethylene Propylene Rubbers) A group of elastomers (rubber-like material) obtained by copolymerization of ethylene and propylene for EPM and a third monomer (diene) for EPDM. Their properties are similar to those of rubber.

EVA (Ethyl-Vinyl Acetate Copolymer) Copolymers of major amounts of ethylene with minor amounts of vinyl acetate that retain many of the properties of polyethylene but have considerably increased flexibility, elongation and impact resistance. EVA is used as a hot melt adhesive for bonding base cups to PET beverage bottles and labels to bottles. EVA is a form of LDPE.

Extrusion The process of forming continuous shapes by forcing molten plastic through a die. Typical shapes are hoses, flat sheets or parisons for blow molding.

Filler A substance (typically inert) added to a plastic compound to reduce its cost or improve physical properties such as hardness, stiffness, impact strength, thermal conductivity or electrical conductivity.

Flake Typically 1/4" or less chips of ground plastic which have been washed, cleaned and dried.

Flexural Modulus The ratio, within the elastic limit, of the applied stress on a test specimen in flexure to the corresponding strain in the outermost fibers of the specimen.

Flexural Strength The maximum stress in the outer fiber at the moment of crack or break. In the case of plastics, this value is usually higher than the straight tensile strength. Also known as modulus of rupture.

Gaylord A container for holding waste plastic, plastic flake or plastic pellets. Often times a gaylord is a cardboard box measuring 34"x43"x38".

Grafted Polymers Polymers may be grafted with a compatibilizer to increase recyclability. A grafted polymer refers to a polymer comprising molecules in which the main backbone chain of atoms has attached to it at various points side chains containing different atoms or groups from those in the main chain. The main chain may be a copolymer or or may be derived from a single monomer. Examples of compatibilizers include methyl methacrylate (MMA)-grafted PE for PE/PVC blending, styrene grafted PE copolymers for PE/PS blends and styrene grafted PVC for PVC/PS blends .

Granulation/Ground Plastic The size reduction of plastic containers to approximate 3/8" or less particle sizes. Granulators have rotating and stationary knives that cut the material. The most efficient models have a tangential feed with blades positioned to produce a scissor-like cut. Capacities range from a few hundred pounds to 5,000 pounds per hour.

HDPE (High Density Polyethylene) Polyethylene plastic having a density typically between 0.940 and 0.960 g/cm^3. While LDPE chains are branched and linked in a random fashion, HDPE chains are linked in longer chains and have fewer side branches. The result is a more rigid material with greater strength, hardness, chemical resistance and a higher melting point than LDPE.

Homopolymer A polymer resulting from the polymerization of a single monomer; a polymer consisting substantially of a single type of repeating unit.

Inhibitor A substance capable of stopping or retarding an undesired chemical reaction. They can be used to prolong storage life or retard degradation by heat and/or light.

Industrial Scrap Plastic material originating from a variety of in-plant operations and which may consist of a single material or a blend of a known composition.

Injection Molding The process of manufacturing with plastic by forcing molten plastic into a mold under pressure.

Izod Impact Strength A measure of impact strength (described in ASTM D256) determined by the difference in energy of a swinging pendulum before and after it breaks a notched specimen held vertically as a cantilever beam. The pendulum is released from a vertical height of two feet, and the vertical height to which it returns after breaking the specimen is used to calculate the energy lost.

LDPE (Low Density Polyethylene) Polyethylene plastic having a density typically between 0.910 and 0.925 g/cm^3. The ethylene molecules are linked in random fashion, with the main chains of the polymer having long and short side branches. The branches prevent the formation of a closely knit pattern, which results in a soft, flexible and tough material.

LLDPE (Linear Low Density Polyethylene) LLDPE is manufactured at much lower pressures and temperatures than LDPE. LLDPE has long molecular chains without the long chain side branches of LDPE, but with the short chain side branches.

Melt Index A single point identification of resin melt viscosity, measured in grams per 10 minute period passing through a specific orifice size at a certain temperature, as dictated by test method ASTM D1238.

Mixed Plastic A mixture of plastics, the components of which may have widely differing properties.

Monomer A compound which typically contains carbon and is of a low molecular weight (compared to the molecular weight of plastics), which can react to form a polymer by combination with itself or with other similar compounds.

Nylon A generic name for a family of resins which have a recurring amide groups (-CO-NH-) as an integral part of the main polymer chain. Nylons are identified by denoting the number of carbon atoms in the polymer chains of each of the constituent compounds which formed the resin. For example, nylon 6,6 refers to the number of carbon atoms in each of the two compounds used to form it.

Off-Spec Plastic Resin that does not meet the manufacturer's specifications.

Parison A hollow tube or other preformed shape of thermoplastic compound which is inflated inside a mold in the blow-molding process.

Pelletizing Cleaned flakes (of a high purity level) are melted and extruded to produce small pellets similar to virgin resin pellets.

PBT (Polybutylene Terephthalate) Similar to PET, but formed using butanediol rather than ethylene glycol (as with PET). PET and PBT are the two thermoplastic polyesters that have the greatest use.

PC (Polycarbonate) PC is characterized by clarity (with optical applications), impact strength and heat resistance. PC is more often used in durable goods production than disposable goods. An easily recognized PC product is 5 gallon water cooler bottles.

PE (Polyethylenes) A family of resins made by polymerizing the gas ethylene (C_2H_4). By varying the catalysts and methods of the polymerization process, its properties can be varied over wide ranges. Some different forms are L/LDPE and HDPE.

PET (Polyethylene Terephthalate) A saturated thermoplastic polyester formed by condensing ethylene glycol and terephthalic acid. It is extremely wear and chemical resistant and dimensionally stable. It also has a low gas permeability in comparison to HDPE, LDPE, PP and PVC which is why it is used so extensively for carbonated beverage bottles.

Phenolics A family of thermosetting resins made by reacting a phenol with an aldehyde. Phenolics are known for good mechanical properties and high resistance to temperature.

Plasticizer A substance or material incorporated into a plastic to increase its flexibility or workability. It may reduce the melt viscosity (or increase the melt index) or lower the resin melting point.

Polyolefins Polymers of relatively simple olefins such as ethylene, propylene and butene. LDPE, HDPE, PP and EVA are polyolefin polymers.

Polyesters A family of resins also known as alkyds. The main polymer backbone is formed through the condensation of polyfunctional alcohols and acids. Polyesters can be saturated (elements or compounds cannot be added to the main backbone) or unsaturated. One of the most important polyester is PET, a saturated polyester.

PP (Polypropylene) A thermoplastic resin made by polymerizing propylene with suitable catalysts. Its density of approximately 0.90 g/cm^3 is among the lowest of all plastics.

Primary Recycling The processing of waste into a product with characteristics similar to those of the original product.

PS (Polystyrene) Polymers of styrene (vinyl benzene). PS is somewhat brittle and is often copolymerized or blended with other materials to obtain desired properties. HIPS (high impact PS) is made by adding rubber or butadiene copolymers. Commonly known PS foams are produced by incorporating a blowing agent during the polymerization process or injecting a volatile liquid into molten PS in an extruder.

PUR (Polyurethanes) A large family of resins based on the reaction of isocyanate with compounds containing a hydroxyl group. PUR can be made into foam or resin, rigid or flexible, thermoset or thermoplastic.

PVC (Polyvinyl Chloride) PVC is produced by polymerization of vinyl chloride monomer with peroxide catalysts. The pure polymer is hard and brittle, but becomes soft and flexible with the addition of plasticizers.

Recycled Plastic Plastic products or parts of a product that have been reground for sale or use to a second party, or plastics composed of post-consumer material or recovered material only (which may or may not have been processed).

Regrind Plastic Plastic products or parts of a product that have been reclaimed by shredding and granulating for use (primarily intended as an in-house term).

Resin A term which is generally used to designate a polymer, a basic material for plastic products. It is somewhat synonymously used with "plastic," but "Resin" (and polymer) most often denotes a polymerized material, while "plastic" refers to a resin which also includes additives such as plasticizers, fire retardants, fillers or other compounds.

Rinsing With all contaminants separated from the plastic containers, clean water is used to rinse off contaminants and any other chemical substance used during washing.

SAN (Styrene-Acrylonitrile Copolymer) A copolymer of about 70% styrene and 30% acrylonitrile, with higher strength, rigidity and chemical resistance over standard PS.

SBS (Styrene-Butadiene-Styrene) A thermoplastic rubber. The styrene and butadiene components are incompatible and form separate phases when mixed which result in rubber-like properties.

Secant Modulus The ratio of total stress to corresponding strain at any specific point on a stress-strain curve.

Secondary Recycling The processing of waste into materials which have characteristics less demanding than those of the original plastic product.

Shredding The size reduction of plastics to 1" to 3" chips. Shredding may be performed prior to granulation to allow for removal of large contaminants such as metal or wood which may damage the granulator.

Sprue In a mold, the sprue is the main feed channel that connects the mold filling orifice to the runners leading to each cavity gate. The term is also used for for the piece of plastic material formed in the channel.

Tensile Strength The maximum tensile stress sustained by a specimen during a tension test. The result is usually expressed in psi, with the area being that of the original specimen at the point of rupture rather than the reduced area after breakage.

Thermoplastic Plastic that can be repeatedly softened by heating and hardened by cooling through a temperature range characteristic of the plastic, and that in the softened state can be shaped by flow into articles by molding or extrusion.

Thermoset Plastic that, after having been cured by heat or other means, is substantially infusible and insoluble. Cross-linking between molecular chains of the polymer prevent thermosets from being melted and resolidified.

Washing Granulated material is washed in a tank with hot or cold water with surfactants (detergents) to loosen and remove contaminants adhering to plastic particles.

Wet Granulation Hot or cold water is added during the granulation process to soften and separate some of the contaminants in the containers.

Yield Strength The stress at which a material exhibits a specified limiting deviation from the proportionality of stress to strain. Unless otherwise specified, the stress will be the stress at the yield point.

Young's Modulus The ratio of tensile stress to tensile strain below the proportional limit.