APPENDIX A:
GLOSSARY OF PLASTICS AND ENGINEERING TERMS

A-stage: Initial or early stage in the reaction of some thermosetting resins, the material is still soluble in certain liquids and fusible; referred to as *resol.*

Acid acceptor: Chemical that acts as a stabilizer by chemically combining with an acid that may be present initially in trace quantities in a plastic; may also be formed via decomposition of the resin.

Acrylic plastics: Group of plastics based on resins generated from the polymerization of acrylic monomers (e.g., ethyl acrylate and methyl methacrylate).

Activation: Process of inducing radioactivity in a material by bombardment with other types of radiation, such as neutrons.

Adherend: A component or body held to another body by an adhesive.

Adhesion: Condition in which two surfaces are bonded together by interfacial forces caused by valence forces or interlocking forces or both. *see also* mechanical and specific Adhesion.

Adhesion, mechanical: Bonding between two surfaces caused by interlocking action of molecules.

Adhesion, specific: Adhesion between surfaces whereby valence forces predominate that are similar to those promoting cohesion.

Adhesive: Material that holds parts together by surface attachment. Examples include glue, mucilage, paste and cement. Various forms of adhesives include liquid or tape adhesives (physical type) and silicate or resin adhesives (chemical type).

Adhesive, assembly: Adhesive for bonding materials togehter, e.g., boat, airplane, furniture, etc; term commonly used in wood chemistry to distinguish between "joint glues" and veneer glues. Term applied to adhesives employed in fabricating finished goods and differs from adhesives used in fabricating sheet materials such as laminates or plywood.

Aging: The effect of exposure of plastics to the environment for a length of time. The specific effect and degree depend on the moisture in, and temperature and composition of the environment, in addition to the length of exposure.

Air vent: Small outlet for preventing gas entrapment.

Alkyd plastics: Group of plastics composed of resins based on saturated polymeric esters whereby the recurring ester groups are an integral part of the primary polymer chain and the ester groups exist in cross-links that are present between chains.

Allyl plastics: Group ofplastics composed of resins formulated by addition polymerization of monomers containing allyl groups (e.g., diallyl phthalate).

Amino plastics: Group of plastics generated by the condensation of amines (e.g. urea and melamine with aldehydes).

Anneal: As applied to molded plastics, the process of heating material to a specified temperature and slowly cooling it to relieve stresses.

Assembly: The positioning or placing together in proper order layers of veneer or other materials, with adhesives, for purposes of pressing and bonding into a single sheet or unit.

Assembly time: Refers to the elapsed time after an adhesive is applied until applied pressure effects curing.

Autoclave: A closed vessel or reactor for chemical reaction to take place under pressure.

B-stage: Intermediate-stage reaction steps for various thermosetting resins. During this stage, the material swells when in contact with

certain liquids and becomes soft when heat is applied. The material may not dissolve or fuse entirely. Resin in this stage is referred to a resitol.

Back-pressure-relief port: Opening from an extrusion die used for excess material to overflow.

Backing plate: Also called support plate, it serves to back up cavity blocks, guide pins, bushings, etc.

Binder: Part of adhesive composition responsible for adhesive forces.

Blanket: Veneers laid up on a flat table. Complete assembly is positioned in a mold at one time; used primarily on curved surfaces to be molded by the flexible bag process.

Blister: Elevation of the surface of a plastic caused by trapped air, moisture, solvent; can be caused by insufficient adhesive, inadequate curint time, or excess temperature or pressure.

Blocking: Adhesion between layers of plastic sheets in contact; condition arises during storage or use when components are under pressure.

Bloom: Visible exudation or efflorescence on the surface of a plastic; caused by plasticizer, lubricant, etc.

Bolster: Spacer or filler material in a mold.

Bond: The attachment at the interface or exposed surfaces between an adhesive and an adherend; to attain materials together with adhesives.

Bulk density: Density of a molding material in loose form, such as granular, nodular, etc., with units g/cm^3 or lb/ft^3.

Bulk factor: Ratio of the volume of loose molding compound to the volume of the same amount in molded solid form; ratio of density of solid plastic component to apparent density of loose molding compound.

C-stage: Final reaction stage of various thermosetting resins. In this stage material is insoluble and infusible. Resin in fully cured thermosetting molding is in this stage and is referred to as resite.

C-veil: Thin, nonwoven fabric composed of randomly oriented and adhered glass fibers of a chemically resistant glass mixture.

Case harden: Process of hardening the surface of a piece of steel to a relatively shallow depth.

Cast film: Film generated by depositing a layer of liquid plastic onto surface and stabilizing by evaporating the solvent, by fusing after deposition or by cooling. Cast films generated from solutions or dispersions.

Catalyst: Material used to activate resins to promote hardening. For polyesters, organic peroxides are used primarily. For epoxies, amines and anhydrides are used.

Cavity: Portion of a mold that forms the outer surface of the molded product.

Cell: Single cavity caused by gaseous displacement in a plastic.

Cellular striation: Layering of cells within a cellular plastic.

Cellulosic plastics: Group of plastics composed of cellulose compounds: for example, esters (e.g., cellulose acetate) and ethers (e.g., ethyl cellulose).

Centrifugal casting: Process in which tubular products are fabricated through the application of resin and glass strand reinforcement to the inside of a mold that is rotated and heated. The process polymerizes the resin system.

Chalking: Dry, chalklike deposit on the surface of a plastic.

Chase: Main portion of the mold, containing the molding cavity, mold pins, guide pins, etc.

Chemically foamed plastic: Cellular plastic whereby the materials' structure is formed by gases generated from the chemical reaction between its constituents.

Clamping plate: Mold plate that matches the mold and is used to fasten the mold to the machine.

Closed-cell foam: Cellular plastic that is composed predominantly of noninterconnecting cells.

Cohesion: Forces binding or holding a single material together.

Cold flow: Creep: the dimensional change of a plastic under load with

time followed by the instantaneous elastic or rapid deformation at room temperature; permanent deformation caused by prolonged application of stress below the elastic limit.

Cold molding: The fashioning of an unheated mixture in a mold under pressure. The article is then heated to effect curing.

Cold pressing: Bonding process whereby an assembly is subjected to pressure without applying heat.

Cold slug: First material to enter an injection mold.

Cold-slug well: Section provides opposite sprue opening of the injection mold, used for trapping cold slug.

Condensation: Chemical reaction whereby two or more molecules combine and separate out water or other substance. When polymers are formed, it is referred to as polycondensation.

Contact molding: Process whereby layers of resin-impregnated fabrics are built up one layer at a time onto the mold surface forming the product. Little or no pressure is required for laminate curing.

Consistency: Resistance of a material to flow or undergo permanent deformation under applications of shearing stresses.

Copolymer: Formed from two or more monomers. See also Polymer.

Core: Portion of the mold that forms the inner surfaces of the molded product.

Core and separator: Center section of an extrusion die.

Core pin: Pin for molding a hole.

Core-pin plate: Plate that holds core pins.

Crazing: Tiny cracks that develop on a laminate's surface. caused by mechanical or thermal stresses.

Creep: *See* Cold flow.

Cross-linking: Generation of chemical linkages between long-chain molecules; can be compared to two straight chains joined together by links. The rigidity of the material increases with the number of links. The function of a monomer is to provide these links.

Cull: Remaining material in the transfer vessel after the mold has been filled.

Cure: Process in which the addition of heat, catalyst or both, with or without pressure, causes the physical properties of the plastic to change through a chemical reaction. Reaction may be condensation, polymerization, or addition reactions.

Degradation: Deleterious change in a plastic's chemical structure.

Delamination: Separation of a laminate's layers.

Deterioration: Permanent adverse change in the physical properties of a plastic.

Diaphragm gate: Gate employed in molding tubular or annular products.

Die-adaptor: Piece of an extrusion die that serves to hold die block.

Die body: Part of an extrusion die that holds the core and forming bushing.

Dilatant: Property of a fluid whose apparent viscosity increases with increasing shear rate.

Dished: Displays a symmetrical distortion of a flat or curved section; as viewed, it appears concave.

Dispersant: In an organosol, the liquid constituent which displays solvating or peptizing action on the resin; subsequent action aids in dispersing and suspending resin.

Dispersion: Heterogeneous mixture in which finely divided material is distributed throughout the matrix of another material. Distribution of finely divided solids in a liquid or a solid (e.g., pigments, fillers).

Doctor bar: Device for regulating the amount of material on the rollers of a spreader.

Doping: Coating a mandrel or mold with a material that prevents the finished product from sticking to it.

Dowel: Pin that maintains alignment between the various sections of a mold.

Draft: Angle of clearance between the molded article and mold, allowing removal from the mold.

Dry spot: Incompleted area on laminated plastics; the region in which the interlayer and glass are not bonded.

Durometer hardness: A material's hardness as measured by the Shore Durometer.

Ejector pin: Pin or dowel used to eject molded articles from a mold.

Ejector-pin-retainer plate: Receptacle into which ejector pins are assembled.

Elasticity: Property of materials whereby they tend to retain or recover original shape and size after undergoing deformation.

Elastomer: A material under ambient conditions that can be stretched and, upon release of the applied stress, returns with force to its approximate original size and shape.

Epoxy plastics: Group of plastics composed of resins produced by reactions of epoxides or oxiranes with compounds such as amines, phenols, alcohols, carboxylic acids, and anhydrides, and unsaturated compounds.

Ethylene plastics: Group of plastics formed by polymerization of ethylene or by the copolymerization of ethylene with various unsaturate compounds.

Evenomation: Softening, discoloration, mottling, crazing, etc. Process of deterioration of a plastic's surface.

Exotherm: Indicates that heat is a given from a reaction between a catalyst and a resin.

Expandable plstics: Plastics that can be transformed to cellular structures by chemical, thermal, or mechanical means.

Extender: A material which, when added to an adhesive, reduces the amount of primary binder necessary.

Extraction: Transfer of materials from plastics to liquids with which they are in contact.

Extrusion: Process in which heated or unheated plastic compound is forced through an orifice, forming a continuous article.

Filament winding: Process in which continuous strands of roving or roving tape are wound, at a specified pitch and tension, onto the outside surface of a mandrel. Roving is saturated with liquid resin

or is impregnated with partially cured resin. Application of heat may be required to promote polymerization.

Filler: Inert material that is added to a plastic to modify the finished product's strength, permanence and various other properties; an extender.

Fin: Portion of the "flash" that adheres to the molded article.

Finishing: Removal of any defects from the surfaces of plastic products.

Fisheye: A clump or globular mass that does not blend completely into the surrounding plastic.

Flash: Excess material that builds up around the edges of a plastic article; usually trimmed off.

Foamed plastic: Cellular structured plastic.

Force plate: A plate used for holding plugs in place in compression molding.

Furane plastics: Group of plastics composed of resins in which the furane ring is an integral portion of the polymer chain; made from polymerization or polycondensation of furfural, furfural alcohol, and other compounds containing furane rings; also formed by reation of furane compounds with an equal weight or less of other compounds.

Fusion: As applied to vinyl dispersions, the heating of a dispersion, forming a homogenous mixtur.

Fusion temperature: Fluxing temperature; temperature at which fusion occurs in vinyl dispersions.

Gel: State at which resin exists before becoming a hard solid. Resin material has the consistency of a gelatin in this state; initial jellylike solid phase that develops during the formation of a resin from a liquid.

Gel coat: Specially formulated polyester resin that is pigmented and contains fillers. Provides a smooth, pore-free surface for the plastic article.

Gel point: Stage at which liquid begins to show psuedoelastic properties.

Gelation: Formation of a gel.

Glass: Inorganic product of a fusion reaction. Material forms upon cooling to a rigid state without undergoing crystallization. Glass is typically hard and brittle and will fracture concoidally.

Glass transition: Transition region or state in which an amorphous polymer changed from (or to) a viscous or rubbery condition to (or from) a hard and relatively brittle one. Transition occurs over a narrow temperature region; similar to solidification of a liquid to a glassy state. This transformation causes hardness, brittleness, thermal expansibility, specific heat, and other properties to change dramatically.

Gum: Class of colloidal substances prepared from plants. Composed of complex carbohydrates and organic acids that swell in water. A number of natural resins are gums.

Halocarbon plastics: Group of plastics composed of resins generated from the polymerization of monomers consisting of a carbon and a halogen or halogens.

Hardener: Compound or mixture that, when added to an adhesive, promotes curing.

Heat treat: Refers to annealing, hardening, tempering of metals.

Hot soils: Soils having a resistivity of less than 1000 $\Omega \cdot$ cm; generally very corrosive to base steel.

Hydrocarbon plastics: Plastics composed of resins consisting of carbon and hydrogen only.

Inhibitor: Material that retards chemical reaction or curing.

Isocyanate plastics: Group of plastics produced by the condensation of organic isocyanates with other plastics. Examples are the urethane plastics.

Isotactic: Type of polymeric molecular structure that contains sequences of regularly spaced asymmetric atoms that are arranged in similar configuration in the primary polymer chain. Materials having isotactic molecules are generally in a highly crystalline form.

Isotropic: Refers to materials whose properties are the same in all directions. Examples are metals and glass mats.

Laminate: Article fabricated by bonding together several layers of material or materials.

Laminated, cross: Laminate in which some of the layers of materials are oriented at right angles to the remaining layers. Orientation may be based on grain or strength direction considerations.

Laminated, parallel: Laminate in which all layers of materials are oriented parallel with respect to grain or strongest direction in tension.

Lignin plastics: Group of plastics composed of resins formulated from the treatment of lignin with heat or by reaction with chemicals.

Line pipe: Pipeline used for transportation of gas, oil, or water; utility distribution pipeline system ranging in sizes from ⅛ to 42 in. OD inclusive. Fabricated to American Petroleum Institute (API) and American Water Works Association (AWWA) specifications.

Lyophilic: Referring to vinyl dispersions, having affinity for the dispersing medium.

Lyophobic: Referring to vinyl dispersions, no affinity or attraction for dispersing medium.

Mechanical tubing: Welded or seamless tubing manufactured in large range of sizes of varied chemical composition (sizes range from 3/16 to 10¾ in OD inclusive for carbon and alloy material); usually not fabricated to meet any specification other than application requirements; fabricated to meet exact outside diameter and decimal wall thickness.

Mechanically foamed plastic: Cellular plastic whose structure is fabricated by physically incorporated gases.

Melamine plastics: Group of plastics whose resins are formed by the condensation of melamine and aldehydes.

Metastable: Unstable state of plastic as evidenced by changes in physical properties not caused by the surroundings. Example is the temporary flexible condition some plastics display after molding.

Mold base: Assembly of all parts making up an injection mold, excluding cavity, cores, and pins.

Molding, bag: Process of molding or laminating in which fluid pressure is applied, usually by means of water, steam, air, or vacuum, to a flexible film or bag that transmits the pressure to the material being molded.

Molding, blow: Method of forming plastic articles by inflating masses of plastic material with compressed gas.

Molding, compression: Process of shaping plastic articles by placing material in a confining mold cavity and applying pressure and usually heat.

Molding, contact pressure: Method of molding or laminating whereby pressure used is slightly greater than is necessary to bind materials together during molding stage (pressures generally less than 10 psi).

Molding, high pressure: Molding or laminating with pressures in excess of 200 psi.

Molding, injection: Process of making plastic articles from powdered or granular plastics by fusing the material in a chamber under pressure with heat and forcing part of the mass into a cooler cavity where it solidifies; used primarily on thermoplastics.

Molding, low pressure: Molding or laminating with pressures below 200 psi.

Molding, transfer: Process of molding plastic articles from powdered, granular, or preformed plastics by fusing the material in a chamber with heat and forcing the mass into a hot chamber for solidification. Used primarily on thermosetting plastics.

Monomer: Reactive material that is compatible with the basic resin. Tends to lower the viscosity of the resin.

Nonrigid plastic: Plastic whose apparent modulus of elasticity is not greater than 10,000 psi at room temperature in accordance with the Standard Method of Test for Stiffness in Flexure of Plastics (ASTM Designation: D747).

Novolak: Phenolic-aldehydic resin that remains permanently thermoplastic unless methylene groups are added.

Nylon plastics: Group of plastics comprised of resins that are primarily long-chain synthetic polymeric amides. These have recurring amide groups as an integral part of principal polymer chain.

Organosol: Suspension of finely divided resin in a volatile organic slurry.

Phenolic plastics: Group of plastics whose resins are derived from the condensation of phenols (e.g., phenol and cresol, with aldehydes).

Piling pipe: Round-welded or seamless pipe for use as foundation piles where pipe cylinder acts as a permanent load-carrying member; usually filled with concrete. Used below the ground in foundation work in the construction industry for piers, docks, highways, bridges, and all types of buildings. Fabricated to ASTME piling specifications (ASTM A252).

Plastic: According to ASTM, a material containing an organic substance of large molecular weight is sold in its finished state, and at some stage in its manufacture into finished goods, it can be shaped to flow.

Plastic, semirigid: Plastic having apparent modulus of elasticity in the range 10,000 to 100,000 psi at 23°C, as determined by the Standard Method of Test for Stiffness in Flexure Plastics (ASTM Designation: D747).

Plastic welding: Joining of finished plastic components by fusing materials either with or without the addition of plastic from another source.

Plasticate: Softening by heating or kneading.

Plasticity: Property of plastics that permits the material to undergo deformation permanently and continuously without rupture from a force that exceeds the yield value of the material.

Plasticize: Softening by adding a plasticizer.

Plasticizer: Material added to a plastic to increase its workability and flexibility. Plasticizers tend to lower the melt viscosity, the glass transition temperature, and/or the elastic modulus.

Plastisol: Suspension of finely divided resin in a plasticizer.

Polyamide plastics: *See* Nylon plastics.

Polyester plastics: Group of plastics composed of resins derived principally from polymeric esters that have recurring polyester groups in the main polymer chain. These polyester groups are cross-linked by carbon-carbon bonds.

Polyethylene: Plastic or resin made by the polymerization of ethylene as the sole monomer.

Polymer: Material produced by the reaction of relatively simple molecules with functional groups that allow their combination to proceed to high molecular weights under suitable conditions; formed by polymerization or polycondensation.

Polymerization: Chemical reaction that takes place when a resin is activated.

Polypropylene: Plastic or resin derived from the polymerization of propylene as the principal monomer.

Polystyrene: Plastic derived from a resin produced by the polymerization of styrene.

Poly(vinyl acetate): Resin derived from the polymerization of vinyl acetate.

Poly(vinyl alcohol): Polymer derived from the hydrolysis of polyvinyl esters.

Poly(vinyl chloride): Resin derived from the polymerization of vinyl chloride.

Poly(vinyl chloride-acetate): Copolymer of vinyl chloride and vinyl acetate.

Pot life: Time period beginning once the resin is catalyzed and terminating when material is no longer workable; working life.

Preform: Coherent block of granular plastic molding compound or of fibrous mixture with or without resin. Prepared by sufficiently compressing material, forming a block that can be handled readily.

Prepolymer: An intermediate chemical structure between that of a monomer and the final resin.

Pressure tubing: Tubing used to convey fluids at elevated temperatures and/or pressures. Suitable for head applications, it is fabricated to exact OD and decimal wall thickness in sizes ranging from ½ to 6 in. OD inclusive and to ASTM specifications.

Primer: Coating that is applied to a surface before application of an adhesive, enamel, etc. The purpose is to improve bonding.

Promoted resin: Resin with an accelerator added but not catalyst.

Reinforced plastic: According to ASTM, those plastics having superior properties over those consisting of the base resin, due to the presence of high-strength fillers embedding in the composition. Reinforcing fillers are fibers, fabrics, or mats made of fibers.

Resin: Highly reactive material which, in its initial stages, has fluidlike flow properties. When activation is initiated, material transforms into a solid state.

Roller: A serrated piece of aluminum used to work a plastic laminate. Purpose of device is to compact a laminate and to break up large air pockets to permit release of entrapped air.

Roving: Bundle of continuous, untwisted glass fibers. Glass fibers are wound onto a roll called a "roving package."

Saran plastics: Group of plastics whose resins are derived from the polymerization of vinylidene chloride or the copolymerization of vinylidene chloride and other unsaturated compounds.

Shelf life: Period of time over which a material will remain usable during storage under specified conditions such as temperature and humidity.

Silicone plastics: Group of plastics whose resins consist of a main polymer chain with alternating silicone and oxygen atoms and with carbon-containing side groups.

Softening range: Temperature range in which a plastic transforms from a rigid solid to a soft state.

Solvation: Process of swelling of a resin or plastic. Can be caused by interaction between a resin and a solvent or plasticizer.

Standard pipe: Pipe used for low-pressure applications such as transporting air, steam, gas, water, oil, etc. Employed in machinery, buildings, sprinkler and irrigation systems, and water wells but not in utility distribution systems; can transport fluids at elevated temperatures and pressures not subjected to external heat applications. Fabricated in standard diameters and wall thicknesses to ASTM specifications, its diameters range from ⅛ to 42 in. OD.

Stress crack: Internal or external defect in a plastic caused by tensile stresses below its short-time mechanical strength.

Structural pipe: Welded or seamless pipe used for structural or load-bearing applications in aboveground installations. Fabricated in nominal wall thicknesses and sizes to ASTM specifications in round, square, rectangular, and other cross-sectional shapes.

Structural shapes: Rolled flanged sections, sections welded from plates and specialty sections with one or more dimensions of their cross section greater than 3 in. They include beams, channels, and tees, if depth dimensions exceed 3 in.

Styrene plastics: Group of plastics whose resins are derived from the polymerization of styrene or the copolymerization of styrene with various unsaturated compounds.

Styrene-rubber plastics: Plastics that are composed of a minimum of 50% styrene plastic and the remainder rubber compounds.

Syneresis: Contraction of a gel, observed by the separation of a liquid from the gel.

Thermoelasticity: Rubberlike elasticity that a rigid plastic displays; caused by elevated temperatures.

Thermoforming: Forming or molding with heat.

Thermoplastic: Reverse of thermoset. Materials that can be reprocessed by applying heat.

Thermoset: Those plastics that harden upon application of heat and cannot be reliquefied, the resin state being infusible.

Thixotropy: Describes those fluids whose apparent viscosity decreases with time to an assymptotic value under conditions of constant shear rate. Thixotropic fluids undergo a decrease in apparent viscosity by applying a shearing force such as stirring. If shear is removed, the material's apparent viscosity will increase back to or near its initial value at the onset of applying shear.

Tracer yarn: Strand of glass fiber colored differently from the remainder of the roving package. It allows a means of determining whether equipment used to chop and spray glass fibers are functioning properly and provides a check on quality and thickness control.

Urea plastics: Group of plastics whose resins are derived from the condensation of urea and aldehydes.

Urethane plastics: Group of plastics composed of resins derived from the condensation of organic isocyanates with compounds containing hydroxyl groups.

Vacuum forming: Fabrication process in which plastic sheets are transformed to desired shapes by inducing flow; accomplished by reducing the air pressure on one side of the sheet.

Vinyl acetate plastics: Group of plastics composed of resins derived from the polymerization of vinyl acetate with other saturated compounds.

Vinyl alcohol plastics: Group of plastics composed of resins derived from the hydrolysis of polyvinyl esters or copolymers of vinyl esters.

Vinyl chloride plastics: Group of plastics whose resins are derived from the polymerization of vinyl chloride and other unsaturated compounds.

Vinyl plastics: Group of plastics composed of resins derived from vinyl monomers, excluding those that are covered by other classifications (i.e., acrylics and styrene plastics). Examples include PVC, poly(vinyl acetate), poly(vinyl butyral), and various copolymers of vinyl monomers with unsaturated compounds.

Vinylidene plastics: Group known as saran plastics.

Weathering: Exposure of a plastic to outdoor conditions.

Yield value: Also called yield stress; force necessary to initiate flow in a plastic.