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Glossary of Terms

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- **Abrasion Resistance -**
the ability to withstand the effects of repeated wearing, rubbing, scraping, etc. that tend to remove material from its surface.
- **Acids -**
one of a class of substances compounded of hydrogen and one or more other elements, capable of uniting with a base to form a salt, and in aqueous solution, turning blue litmus paper red.
- **Acrylic Resins -**
a class of thermoplastic resins produced by polymerization of acrylic acid derivatives.
- **Acrylonite - Butadiene - Styrene (ABS) -**
plastics containing polymers and/or blends of polymers, in which the minimum butadiene content is 15 percent, the minimum acrylonitrile content is 15 percent, the minimum styrene and/or substituted styrene content is 15 percent, and the maximum content of all other monomers is not more than 5 percent, and lubricants, stabilizers, and colorants.
- **Adhesive -**
a substance capable of holding materials together by surface attachment.
- **Aging -**
the effect of time on materials.
- **Aliphatic -**
derived from or related to fats and other derivatives of the paraffin hydrocarbons, including unsaturated compounds of the ethylene and acetylene series.
- **Alkalis -**
compounds capable of neutralizing acids and usually characterized by an acid taste. Can be mild like baking soda or highly caustic like lye.
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- **Alkyd Resins -**

a class of resins produced by condensation of a poly-based acid or anhydride and a polyhydric alcohol.

- **Allyl Resins -**

a class of resins produced from an ester or other derivative of allyl alcohol by polymerization.

- **Amorphous -**

Latin meaning without form. Non-crystalline structure.

- **Anneal -**

to prevent the formation of or remove stresses in plastics by cooling from a suitable temperature.

- **Arc Resistance -**

1) the resistance to the flow of current offered by the voltaic arc (i.e., if the carbons of an arc lamp are 1/32" apart, the arc resistance will be 1 ½ Ohms). 2) the resistance of a material to the effects of an arc passing across its surface stated as a measure of the total elapsed time taken to form a conducting path (of material carbonizing by the arc flame) across the surface under prescribed conditions of application of a high voltage, low current arc (as across an insulator).

- **AWG -**

abbreviation for American Wire Gauge, a standard system for designating wire diameter.

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- **Base -**

the material woven (such as paper, woven cotton glass fabric, or glass fiber mat, felted asbestos, aramid fibers, graphite and Nylon® fabrics) in the form of sheets or rolls which can be impregnated with resin to form laminated plastics.

- **Binder -**

the organic or inorganic material which encapsulates and holds together the base in reinforced or otherwise heterogeneous composites.

- **Bond -**

to attach by means of adhesive.

- **Bond Strength -**

1) the measure of the force required to separate objects or materials bonded together. 2) the strength of the bond between fiber and matrix. 3) the degree of attraction between

adjacent atoms within a molecule usually expressed in J/mol.

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- **Calendaring** -

a process by which a heated rubber plastic product is squeezed between heavy rollers into a thin sheet or film. The film may be frictioned into the interstices of cloth, or it may be coated onto a cloth or paper.

- **Canvas** -

a cotton fabric weighing more than four ounces per square yard. (Used as the base material for NEMA grades C, CE and some L grade laminates).

- **Cast Resin** -

a resinous product prepared by pouring liquid resins into a mold and heat-treating the mass to harden it.

- **Catalysis** -

the acceleration (or retardation) of the speed of a chemical reaction by the presence of a comparatively small amount of a foreign substance called a catalyst.

- **Cellulose** -

chemically a carbohydrate, which is the chief component of the solid structure of plants, wood, cotton, linen, etc. The source of the cellulosic family of plastics

- **Cellulose Acetate** -

a class of resins made from a cellulose base. Either cotton linters or purified wood pulp, by the action of acetic anhydride and acetic acid.

- **Cellulose Acetate Butyrate** -

class of resins made from a cellulose base. Either cotton linters or purified wood pulp, by the action of acetic anhydride, acetic acid and butyric acid.

- **Coefficient of Friction** -

static: the ration of the limiting friction developed to the corresponding normal pressure, if two surfaces move relative to each other.

- **Coefficient of Thermal Expansion** -

the unit change in dimension of a material for a unit change in temperature.

- **Cold Flow** -

change in dimensions or shape of some materials when subjected to external weight or pressure at room temperature

- **Composite** -

1) structure or an entity made up of distinct components. 2) complex material, such as fiberglass, in which two or more distinct, structurally complementary substances, especially glass and polymers, combine to produce structural or functional properties not present in any individual component. 3) reinforced laminates (i.e., canvas phenolic, glass epoxy, etc.).

- **Compound** -

a combination of ingredients before being processed or made into a finished product.

Sometimes used as a synonym for material formulation.

- **Compressive Strength** -

crushing a load at failure divided by the original sectional area of the specimen.

- **Conductivity** -

the reciprocal of volume resistivity. It is the conductance of a unit cube of any material.

- **Copolymer** -

a polymer formed through the inter-polymerization of two (or more) chemically different monomers with each other.

- **Copper Clad Laminate** -

laminates (i.e., FR4) having copper foil bonded to one or both surfaces and intended primarily for use in printed circuits.

- **Corrosion** -

chemical action which caused destruction of the surface of a material by oxidation or chemical combination. Also caused by reduction of the electrical efficiency between a metal and a contiguous substance or to the disintegrating effects of strong electrical currents or ground return currents in electrical systems. The latter is known as electrolytic corrosion.

- **Crazing** -

minute lines appearing in or near the surface of materials such as plastics, usually resulting as a response to environment. Crazing cannot be felt by running a fingernail across if (if the fingernail catches, it is a crack).

- **Creep** -

the dimensional change with time of a material under load. At room temperature it is also called cold flow.

- **Crosslinking** -

the setting-up of chemical valence links between the molecular chains of polymer molecules, leading to the formation of a three-dimensional network of polymer chains which is infusible and insoluble. This usually reduces the thermoplasticity of the material.

- **Crystallinity** -

a molecular structure resulting from the formation of solid crystals with a geometric pattern.

- **Cure** -

to change the physical, chemical, or electrical properties of a material by chemical reaction, by the action of heat and catalysts alone or in combination, with or without pressure.

Specifically, to convert a low molecular weights polymer or resin to an insoluble, infusible state.

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- **Deflection Temperature** -

the temperature at which a specimen will deflect a given distance at a given load under prescribed conditions of test.

- **Degradation** -

a deleterious change in the physical properties of a plastic evidenced by impairment of these properties.

- **Delamination -**

the separation of the layers of material in a laminate.

- **Density -**

weight per unit volume of a given substance.

- **Dielectric -**

1) any insulation medium which intervenes between two conduits and permits electrostatic attraction or repulsion to take place across it. 2) a material having the property that energy required to establish an electric field is recoverable in whole or in part, as electric energy (see insulation for clarification).

- **Dielectric Constant (Permittivity or Specific Inductive Capacity) -**

the specific inductive capacity of a dielectric. That property of a dielectric which determines the electrostatic energy stored per unit volume for unit potential gradient.

- **Dielectric Strength -**

the voltage which an insulating material can withstand before breakdown occurs, usually expressed as a voltage gradient (such as volts per mil).

- **Dimensional Stability -**

ability to retain precise shapes and size.

- **Dissipation -**

unusable or lost energy, as the production of heat in a circuit.

- **Dissipation Factor (loss tangent, tans, approximate power factor) -**

the tangent of the loss angle of the insulating material.

- **Durometer -**

trade name of the Shore Instrument Company for an instrument that measures hardness. The Durometer determines the 'hardness' of rubber or plastics by measuring the depth of penetration (without puncturing) of a blunt needle compressed on the surface for a short period of time.

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- **Elastic Limit -**

the load at which a material will no longer return to its original form when the load is released.

- **Elasticity -**

that property of plastics materials by virtue of which they tend to recover their original size and shape after deformation.

- **Elastomer -**

the name applied to substances having rubber-like properties.

- **Elongation -**

the fractional increase in length of a material stressed in tension.

- **Environmental Stress Cracking -**

cracks that develop when the material is subjected to stress in the presence of specific chemicals.

- **Epoxy Resins -**

straight-chain thermosetting resins containing at least one three-membered ring consisting of two carbon atoms and one oxygenation.

- **Ester -**

a compound formed by the reaction between an alcohol and an acid. Many esters are liquids. They are frequently used as plasticizers in rubber and plastic compounds.

- **Ethyl Cellulose -**

a thermoplastic material prepared by the ethylation of cellulose by diethyl sulfate or ethyl halides and alkali.

- **Extrusion -**

the method of processing plastic by forcing heat softened plastic through an opening of the desired shape of the cross-section of the finished product.

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- **Fabric-Base Laminate -**

laminated insulating material formed by bonding woven cloth (of fiberglass, cotton or synthetic fibers) with resin under heat and pressure.

- **Fahrenheit -**

equals 1.8 multiplied to the sum of the temperature in Celsius and $^{\circ}\text{F} = 1.8 \times (^{\circ}\text{C} + 32)$.

- **Fiber -**

a thread or threadlike structure such as cellulose, wool, silk or glass yarn.

- **Fibre -**

1) a specific form of chemically jelled fibrous materials manufactured in sheets, rods and tubes. 2) commonly used interchangeably with fiber.

- **Filament Winding -**

resin impregnated roving or single strands of glass or other reinforcement wound in a predetermined pattern onto a suitable form or mandrel and then cured.

- **Filler -**

a relatively inert material added to a plastic to modify its strength, performance, working properties, or other qualities or to lower costs.

- **Fishpaper -**

1) a type of vulcanized fibre paper treated chemically for insulating purposes where high mechanical and electrical strength and flexibility are required. 2) a vulcanized fibre in thin cross-section.

- **Flammability -**

the time a specimen will support a flame after having been exposed to a flame for a given period.

- **Flash Point -**

the lowest temperature at which a flammable liquid will produce a combustible vapor that will burn in the presence of a flame, under certain prescribed conditions of test.

- **Flexural Strength -**

the strength of a material in bending, expressed as the tensile stress of the outermost fibers of a bent test specimen at the instant of failure.

- **Formulation -**

1) a combination of ingredients before processing or made into a finished product. Also used as a synonym for a material, compound. 2) a selection of components of a product formula or mixture to produce optimum specific properties for the end-use desired.

- **Fuse -**

to join two plastic parts by softening the material through heat or solvents.

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- **Glass Cloth -**

fabric used as insulating material base formed by weaving yarns comprising glass filaments and possessing high strength, heat resistance and dielectric properties.

- **Glass Fiber -**

glass in fibrous form that has cooled to a rigid condition without crystallizing.

- **Graves Tear Strength -**

the force required to rupture a specimen by pulling a prepared notched sample.

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- **Heat Distortion Point -**

the temperature in degrees Celsius at which a standard test bar (ASTM D648) deflects 0.010 in under a stated load of either 66 or 264 psi, when the temperature is raised at a specific rate of increase. power dissipated as heat.

- **Heat Joining -**

making a pipe joint by heating the edges of the parts to be joined so that they fuse and become essentially one piece with or without the addition of additional material.

- **Heat Loss -**

power dissipated as heat

- **High Pressure Laminates (molding pressure high) -**

laminates molded and cured at pressure not lower than 1,000 psi (pressures of 1,000 to 2,500 psi are not uncommon).

- **Heat Resistance -**

the ability to withstand the effects of exposure to high temperature. Care must be exercised in defining precisely what is meant when this term is used. Descriptions pertaining to heat resistance properties include boilable, washable, cigarette-proof, sterilizable, etc.

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- **Impact Resistance -**

relative susceptibility of material to fracture by stress at high speeds.

- **Impact Strength -**

ability to withstand physical shock loading or work required to fracture under shock loading a specified test specimen in a specified manner.

- **Inert -**

deficient in active properties: not affecting other substances when in contact with them such as inert gases not participation in any fashion in chemical reactions.

- **Infrared -**

the band of light in the electromagnetic spectrum that lies between the visible light range and the radar range.

- **Injection Molding -**

method of forming plastic to the desired shape by forcing heat-softened plastic into a relatively cool cavity where it rapidly solidifies (freezes).

- **Insulation -**

material having a high resistance to the flow of electric current, to prevent leakage of current from a conductor.

- **Insulation Resistance -**

the ratio of the applied voltage to the total current between two electrodes in contact with a specific conductor under prescribed conditions of test.

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- **Ketones -**

compounds containing the carbonyl group (CO) to which is attached two alkyl groups. Ketones, such as methyl ethyl ketone, are commonly used as solvents for resins and plastics.

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- **Laminate -**

to build up to desired shape or thickness. (noun) – a material composed of successive layers of material, usually bonded together under heat and pressure.

- **Light Stability -**

ability of a plastic to retain its original color and physical properties upon exposure to sun or artificial light.

- **Light Transmission -**

the amount of light that a plastic will allow to pass, dependent due to the effects of aging and weathering.

- **Longitudinal Stress -**

the amount of light that a plastic will allow to pass, dependent due to the effects of aging and weathering.

- **Low Pressure Laminates -**

laminates molded and cured in the range of pressures from 400 psi down.

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- **Mat -**

1) a randomly distributed felt of fibers, usually glass, used in reinforced plastics. 2) a nonwoven fabric of fibrous material used as a plastic reinforcement.

- **Mica -**

a transparent, flaky material which splits into thin sheets and has excellent insulating and heat resisting properties, consisting of orthosilicates of aluminum or potassium, occurs naturally.

- **Modulus -**

the load in pounds per square inch (or kilos per square centimeter) of initial cross-sectional area necessary to produce a stated percentage-elongation which is used in the physical description of plastics (stiffness).

- **Modulus of Electricity -**

the ratio of the stress per square inch to the elongation per inch due to this stress.

- **Moisture Resistance -**

the ability of a material to resist absorbing ambient moisture.

- **Molding, Compression -**

a method of forming objects from plastics by placing the material in a confining mold cavity and applying pressure and usually heat.

- **Monomer -**

the simple, unpolymerized form of a compound which is the building block of a polymer.

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- **Nonrigid Plastic -**

a plastic which has a stiffness in flexure of plastics elasticity of not over 10,000 psi 23°C which determined in accordance with the Standard Method of Test for Stiffness in Flexure of Plastics.

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- **Olefin Plastics -** plastics based on resins made by the polymerization of olefins or copolymerization of olefins with other unsaturated compounds, the olefins being in greatest amount by weight polyethylene, polypropylene, and polybutylene are the most common olefin plastics encountered in pipe.

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- **Permeability -**

1) the passage or diffusion (or rate of passage) of a gas, vapor, liquid, or solid through a barrier without physically or chemically affecting it. 2) the ability of a material to carry magnetism as compared to air which has a permeability of one.

- **Permittivity -**

preferred term for dielectric constant. It is that property of a dielectric material that determines how much electrostatic energy can be stored per unit of volume when unit voltage is applied; the relative permittivity of most materials varies from 2 to 10, air having 1.

- **Phenolic Resin -**

1) a synthetic resin produced by the condensation of phenol with an aldehyde (usually formaldehyde). 2) any of several types of thermoset plastics obtained by the condensation of phenol or substituted phenols.

- **Plastic -**

1) high polymeric substances, including both natural and synthetic products, but excluding the rubbers that are capable in their manufacture of flowing under heat and pressure. 2) a material that contains an organic substance of large molecular weight, solid in finished state.

- **Plasticity -**

a property of plastics and resins which allows the material to be deformed continuously and permanently without rupture upon the application of a force that exceeds that yield value of the material.

- **Plasticizer -**

chemical agent added to plastics to make them softer and more flexible.

- **Polybutylene -**

a polymer prepared by the polymerization of butene-1 as the sole monomer.

- **Polyethylene -**

a polymer prepared by the polymerization of ethylene as the sole monomer.

- **Polymer -**

1) a compound formed by the chemical union of two or more monomers of the same kind.
2) a synthetic or natural compound of high molecular weight.

- **Polymerization -**

chemical change resulting in the formation of a new compound whose molecular weight is usually a large multiple of that of the original substance.

- **Polypropylene -**

a polymer prepared by the polymerization of propylene as the sole monomer.

- **Polystyrene -**

a plastic based on a resin made by polymerization of styrene as the sole monomer.

- **Polyvinyl Chloride -**

polymerization vinyl chloride, a synthetic resin, which when plasticized or softened with

other chemicals has some rubber-like properties. It is derived from acetylene and hydrochloric acid.

- **Porosity -**

presence or numerous visible voids.

- **Propylene Plastics -**

plastics based on resins made by the polymerization of propylene or copolymerization of propylene with one or more other unsaturated compounds, the propylene being in greatest amount by weight.

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- **Reinforced Plastic -**

a plastic with some strength properties greatly superior to those of the base resin, resulting from the presence of high strength fillers imbedded in the composition.

- **Reinforcement -**

material used to reinforce, strengthen or give dimensional stability to another material; can be chopped, woven or braided.

- **Resilience -**

usually regarded as another name for elasticity. While both terms are fundamentally related there is a distinction in meaning. Elasticity is a general term to describe the property of recovering original shape after a deformation. Resilience refers more to the speed of recovery; that is, a body may be elastic but not highly resilient.

- **Resin -**

a substance that is polymeric in structure and predominantly amorphous. 2) an alternative term, like polymer, to the predominately used name of plastic.

- **Resistance -**

property of a conductor that opposed the current flow produced by a given difference of potential. The ohm is the practical unit of resistance.

- **Rigid Plastic -**

a plastic which has a stiffness or apparent modulus of elasticity greater than 100, 000 psi as 23°C when determined in accordance with the Standard Method of Test for Stiffness in Flexure of plastics.

- **Rockwell Hardness -**

a test for hardness (resistance to indentation) in which a hardened steel ball or diamond point is pressed into the material under test.

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- **Self-extinguishing -**

the ability of a plastic to resist burning when the source of heat or flame that ignited it is removed.

- **Shear Strength -**

1) ability of a material to withstand shear stress or stress at which a material fails in shear.

2) the maximum shear strength stress that a material is capable of sustaining.

- **Solvent Content** -

in the plastic field, a solvent adhesive that contains a solvent that dissolves or softens the surfaces being bonded so that the bonded assembly becomes essentially one piece of the same type of plastic.

- **Specific Gravity** -

the density of any material divided by that of water at a standard temperature.

- **Specific Heat** -

ratio of the thermal capacity of a substance to that of water at 15°C. Heat required to raise 1 gram of material, such as discoloration due to heat or light.

- **Stabilizer** -

a chemical substance which is frequently added to plastic compounds to inhibit undesirable changes in the material, such as discoloration due to heat or light.

- **Strain** -

the ratio of the amount of deformation to the length being deformed caused by the application of a load on a piece of material.

- **Strength** -

the mechanical properties of a plastic such as a load or weight-carrying ability to withstand sharp blows. Strength Properties include tensile, flexural, and tear strength, toughness, and flexibility, etc.

- **Stress-Crack** -

external or internal cracks in a plastic caused by tensile stress less than that of its short-time mechanical strength.

- **Stress Relaxation** -

the decrease of stress with respects to time in a piece of plastic that is subject to an external load.

- **Styrene Plastics** -

plastics based on resins made by the polymerization of styrene or copolymerization of styrene with other unsaturated compounds, the styrene being in greatest amount by weight.

- **Styrene-Rubber Plastics** -

compositions based on rubbers and styrene plastics, the styrene plastics being in greatest amount by weight.

- **Surface Resistivity** -

the resistance of a material between two opposite sides of a unit square of its surface.

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- **Tear Strength -**

1) force required to initiate or continue a tear in a material under specified conditions. 2) the force acting substantially parallel to the major axis of the test specimen.

- **Tensile Strength -**

the longitudinal stress required to break a prescribed specimen divided by the original cross-sectional area at the point of rupture (usually express in lbs. Per square inch), within the gauge boundaries sustained by the specimen during the test.

- **Thermal Conductivity -**

the ability of a material to conduct heat; physical constant for quantity of heat that passes through volume of a substance in unit of time for unit difference in temperature.

- **Thermal Expansion -**

the increase in length of a dimension under the influence of an increase in temperature.

- **Thermoplastic -**

plastics capable of being repeatedly softened by increases in temperature and hardened by decreases in temperature. These changes are physical rather than chemical.

- **Thermoset -**

a classification of plastic resin that cures by chemical reaction when heated and, once cured, cannot be re-softened by heating.

- **Translucent -**

permitting the passage of light, but diffusing it so that objects beyond cannot be clearly distinguished.

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- **Vinyl Chloride Plastics -**

plastics based on resins made by the polymerization of vinyl chloride or copolymerization of vinyl chloride with minor amount (not over 50 percent) of other unsaturated compounds

- **Vinyl Plastics -**

plastics based on resins made from vinyl monomers except those specifically covered by other classification, such as acrylic and styrene plastics. Typical vinyl plastics are polyvinyl chloride, polyvinyl monomers with unsaturated compounds.

- **Virgin Material -**

a plastic material in the form of pellets, granules, powders, floc, or liquid that has not been subjected to use or processing other than that required for its original manufacture.

- **Viscosity -**

internal friction of a liquid because of its resistance to shear, agitation, or flow.

- **Volatile -**

property of liquids to pass away by evaporation.

- **Volume Resistivity -**

resistance between opposite faces of 1 cm cube of material, usually in ohm-cms.

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- **Water Absorption -**

the percentages by weight or water absorbed by a sample immersed in water. Dependent upon area exposed, and the time of exposure.

- **Weather Resistance -**

ability of a plastic to retain its original physical properties and appearance upon prolonged exposure to outdoor weather.

- **Welding -**

the joining of two or more pieces of plastics by fusion of the material in the pieces at adjoining or nearby areas either with or without the addition of plastic from another source.

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- **Yield Strength -**

the stress at which a plastic material exhibits a specified limiting permanent set.

- **Yield Point -**

the point at which a plastic material will continue to elongate at no substantial increase in load during a short test period.

- **Yield Stress -**

the stress at which a plastic material elongates without further increase of stress. Up to this point, the stress-strain relationship is linear (Young's Modulus).

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