M.I.C.I.
Midwest Industrial Coatings, Inc.

Solvent Base Specifications

For More Information Call
1-952-252-2000

What is Urethane?

Urethane or polyurethane is a generic name for a family of materials that include foams, films, elastomers, and inks. Within the limits set by the term “urethane coatings” the ASTM (American Society for Testing Materials) recognizes five distinctly different types of materials, but virtually all the major coatings manufacturers will agree that a fully crosslinked, aliphatic, ASTM Type V polyurethane is the most durable, most practical long-term finish available today.

The Crucial Difference: Crosslink Density

Even within this tight ASTM definition there are substantial differences in the long-term performance that can confuse purchasing decisions. Some of these differences are subtle differences in formulation, molecular configuration or UV screening agents. The most critical difference between high and low-density crosslink urethanes is the actual number of chemical bonds holding the molecules together. Low crosslink density urethanes, those that require relatively low levels of crosslinking catalyst, dry quickly and have similar application and repair properties to lacquers. Performance is dramatically better than standard enamels, but application is limited to spray and there is only moderate resistance to hard use, strong solvents and graffiti removal. Highly crosslinked 2-component urethanes, generally mixed 1 to 1, are slower to cure, but can be brush and roller applied, as well as sprayed or silk-screened while providing the finest initial gloss with the best long term color, gloss retention, and outstanding protection from stains and aggressive environments.

Modified Automotive Urethanes

Lightly crosslinked urethane modified enamels, such as the automotive type urethane finishes, behave more like alkyds than a fully cured urethane. Visualized as a piece of chain-link fence, the linkages within this finish add tremendous strength and dimensional stability to a seemingly fragile structure. The weave is loose and mobile. This is an applicator convenience. The loose crosslink leaves the coating pliable and temperature sensitive enough to be easily repaired, huffed, or refinished.

Unfortunately, the low crosslink densities and thermoplastic properties needed to make a coating easy to touch up and buff will also compromise the rigidity and integrity of the film, reducing its long term durability.

Industrial Acrylic Urethanes

Transportation grade urethanes, often found on high quality commercial and agricultural vehicles, are generally based on acrylic backbones and tend to be mixed at a ratio of three parts color base for every one part crosslinker. Visualized as chicken wire, these are tough, durable finishes, but are not as easy to touch up and repair as lacquers or automotive-type urethanes. Acrylics generally cannot be brush applied and are not designed to stand up to strong solvents or harsh industrial environments. We offer premium industrial acrylic urethanes to production line customers.

GLOSSARY OF TERMS

The following painting terms are abstracted from the glossary of Understanding Paint and Painting Processes

acetone A powerful ketone-type lacquer solvent.

acrylic A coating based on a polymer containing short-chain esters of acrylic and methacrylic acid. Acrylics are widely used as automotive topcoats. Their physical properties can be con-trolled in part by the choice of the alcohol used to make the ester.

active solvent A liquid that can dissolve a paint binder when used alone.

additive Any one of a number of special chemicals added to a paint to bring about special effects. Examples are plasticizers, light stabilizers, and fungicides.

adhesion The phenomenon by which one material is attached to another by means of surface attraction.

agglomerate Clumps of pigment crystals that have formed loose clusters containing entrapped air. Usually undesirable in paint, as they tend to settle out and have poor optical properties.

aliphatic solvent A type of solvent comprised mainly of straight-chain hydrocarbons Examples are gasoline, kerosene, hexane, and naphtha.

alkyd A coating based on a polyester binder. The polyester binders are chemical combinations of molecules that contain more than one acid or alcohol group. Alkyds are widely used in water-based house paints and automotive primers.

anhydride A reactive form of dicarboxylic acid containing a monomer that has one mole of water removed. The major anhydride used in the synthesis of alkyds is phthalic anhydride.

anti-skinning agents Chemicals added to a paint to help prevent the formation of a surface film on the paint.

aromatic A type of solvent based on benzene ring molecules. Aromatics are often used as diluents in acrylic lacquers Typical examples are ben-zene. xylol. and toluol.

benzoic acid An aromatic monocarboxylic acid used in terminating chain growth in polyester or alkyd polymers. Also used in the manufacture of plasticizers.

beta rays Beams of electrons that can be used to cure certain kinds of paint.

binder The paint material that forms the film, so called because it binds the pigment and any additives present into a solid durable film. Also referred to as the resin.

branched polymer A polymer that has some branching along its backbone chain. An example is low-density polyethylene.

catalyst A chemical used to change the rate of a chemical reaction. Differs from a curing agent in that the catalyst is not itself chemically consumed in the reaction, while a curing agent is. Technically, catalysts that increase reaction rates are called accelerators; those that decrease reaction rates are called inhibitors or retarders.

cathodic protection The prevention of corrosion of a metal by electrically connecting it to a sacrificial anode. The anode is itself decomposed, and the object of interest is protected. The sacrificial anode must be replaced periodically.

coalescence The fusing or flowing together of liquid or solvent particles.

colloids Aggregates of molecules in solution (dispersion) resulting in particles having dimensions in the 0.001 milli micron to 1000 micron range.

condensation cure Any crosslinking process that liberates water and other simple molecules during the reaction.

conjugated double bond Two double bonds in alternate posi-tions as indicated by the formula -CH-CH-CH-CH-.

copolymer A polymer comprised of two or more different monomer units.

critical pigment volume concentration (CPVC) The volume percent pigment in a coating in which the pigment parti-cles are surrounded by resin so that no free surface pigment exists cure. The process by which paint is converted from the liquid to the solid state.

Desmodur N® An aliphatic-type polyisocyanate commercially available from Mobay Chemicals.

diluent A liquid that extends a solution but definitely acts to weaken the solvent power of the active solvent.

double bond An unsaturated hydrocarbon of the type CnHn with the formula -C=C-, indicated by the suffix -ene.

drier A catalyst added to speed the cure of oil-based paints. Driers are often metal salts of carboxylic acids.

drying oil A water-insoluble liquid, usually obtained from a plant source, that reacts with oxygen (from the air) to form a crosslinked polymeric film.

electrocoating (E-coat) See ìelectrodeposition.î

electrodeposition The process by which electrically charged paint is plated on conductive surfaces of the opposite charge.

electrolyte A substance that dissociates to some extent into two or more ions in water and other polar solvents. Solutions of electrolyte conduct electrical current and can be decomposed by it (electrolysis).

electron beam curing A system for curing paint films using the energy of an electron beam. The process lends itself to high-speed curing of paint on flat surfaces. Special paints must be used and personal shielding is required.

electron beam radiation Radiation generated from high-energy electrons that is used in crosslinking coating systems.

electrostatic spray The process by which paint particles are electrically charged and attracted to a substrate bearing an opposite charge.

emulsion polymerization The formation of a polymer in which the growing polymer molecules form droplets in the reaction medium This situation arises when the solvent can dissolve the monomer, but not the polymer.

emulsion A class of colloidal dispersions containing two or more immiscible liquids such as oil in water. Emulsions are usually unstable and will separate into their components unless a stabilizing agent is present.

enamel A broad classification of free-flowing clear or pig-mented varnishes, treated oils, or other forms of organic coat-ings that usually dry to a hard, glossy or semi glossy finish.

epoxy Synthetic resins formed by the condensation of epi- chiorohydrin and bisphenol-A.

exempt solvents Solvents that are not subject to air pollution legislation. Many alcohols, esters, some ketones, and mineral spirits are exempt. Aromatic and some ethylenic compounds are not exempt, and their use as solvents is there-fore subject to regulation.

flash time The time between paint application and baking. Usually a considerable quantity of solvent is lost during this interval, and this solvent loss prevents popping problems in the oven.

functionality Ability of a compound to form covalent bonds.

gamma radiation High-energy radiation, similar to X-ray radiation, that is emitted by radioactive substances.

glass transition temperature The temperature at which polymer molecules are able to move fairly freely in the solid state.

hiding power The ability of a paint to mask the color or pattern of a surface. Usually expressed as square feet per gallon or square meters per liter.

high-solids paint Paint containing 35-80% solids. These pro-ducts have become popular because of the reduction in solvent emissions associated with their use.

homopolymer A polymer containing only one kind of monomer.

inhibitor A chemical added to retard some particular reaction. Examples are antioxidants and anti-skinning agents.

interfacial free energy The minimum amount of work required to create an interface between two immiscible materials.

latent solvent A liquid that cannot itself dissolve a binder but increases the tolerance of the paint for a diluent.

linear polymer A polymer containing little or no branching Examples are high-density polyethylene and nitrocellulose or acrylic lacquers.

molecular weight The relative mass of a molecule in relation to that of a hydrogen atom, It is obtained by adding together the atomic weights indicated in the formula of the substance.

monomers Low-molecular-weight reactive materials that are used in the synthesis of polymers.

nonconjugated double bond Double bonds that are not in the relationship outlined under conjugated double bonds. They are indicated by the formula -C-C=C-C-C=C-C.

oil-based paints Paints with films that form solids by the air-induced crosslinking of certain unsaturated plant oils known as drying oils. Oxygen is consumed in the process.

paint A material that when applied as a liquid to a surface forms a solid film for the purpose of decoration and/or protection. Generally, a paint contains a binder(s), solvent(s), and a pigment(s). Often other materials are present to give special properties to the paint film. Examples of such additives are rust inhibitors, light stabilizers, and softening agents (plasticizers).

percent solids The percent mass of a paint due to its nonliquid components.

pigment Small particles added to the paint to influence properties such as color, corrosion resistance, and mechani-cal strength.

pigment volume concentration (PVC) The percent volume of a paint film occupied by the pigment.

plasticizer A low-molecular-weight material added to polymeric materials such as paints, plastics, or adhesives to improve their flexibility.

polyamides Polymeric compounds synthesized by the reaction of amine and carboxylic-containing compounds. They are sometimes amine terminated and used in the crosslinking of epoxide polymers.

polymers Large molecules built up by the combination of many small molecules.

primer A type of paint applied to a surface to increase its compatibility with the topcoat or to improve the corrosion resistance of the substrate.

refractive index The ratio of the velocities of light in a medium and in air under the same conditions. The result is that light passing from one medium to another is bent to some degree.

skinning The formation of a thin, tough film on the surface of a liquid paint film, usually due to reaction with the air or to rapid solvent loss.

styrene An unsaturated reactive monomer used extensively in the synthesis of polymers. It can also be used to thin out reactive polyesters with subsequent crosslinking in the ethylenic groups.

thermoplastic A type of polymer that softens and melts when heated and then resolidifies upon cooling. Thermoplastics generally have linear or branched structures.

thermosetting A type of polymer that does not soften appreci-ably when heated. Thermosets may char when heated in air. They are generally crosslinked polymers.

thixotropy The tendency for the viscosity of a liquid to be shear-rate dependent. When the liquid is rapidly shaken, brushed, or otherwise mechanically disturbed, the viscosity decreases rapidly. Thixotropic behavior is the result of molecules or particles in the liquid forming weakly associated structures that break apart when agitated.

throwing power The ability of an electrodeposition resin to coat recessed areas, usually measured by noting the coating distance up a cylindrical tube that is coated in an electro-deposition bath.

topcoat Usually the final paint film applied to a surface.

ultraviolet radiation High-energy short-wavelength radiation used in coatings to crosslink primarily acrylic and methacrylic systems by means of free-radical reactions.

UV stabilizers Chemicals added to paint to absorb the ultra-violet radiation present in sunlight. Ultraviolet radiation decomposes the polymer molecules in a paint film, and thus UV stabilizers are used to prolong paint life.

vehicle The combination of binder and solvents or diluents, which are used to put the binder in a liquid, usable form.

vinyl cure A curing process involving the crosslinking of vinyl groups.

vinyl toluene An unsaturated, aromatic monomeric compound reacted into oil-modified alkyds to modify its drying properties.

viscosity The property of liquid that enables it to resist flow, often measured by the time required for a given volume of liquid to flow through a small hole in the bottom of a cup under controlled conditions. A thick liquid-like molasses has a high viscosity.

volatile organic compounds (VOC) Volatile organic materials, such as solvents, that are present in many coating products.