HEALTH AND SAFETY ASPECTS OF ACRYDUR® RESINS

Methacrylate resins such as Acrydur® utilize methyl methacrylate (MMA) monomer as the main component. MMA has a history dating back to the 1940s and finds use in various applications. Acrylic glass for window panes, molding powders for automobile tail lamp lenses, packaging seals, prosthetic devices, etc., all make use of the polymerized form of MMA, poly (methyl methacrylate) (PMMA). MMA has also found use in the formulation of dental and constructions adhesives. MMA consumption for all applications in the U.S. will approach one billion pounds this year.

Acrydur® resins in general and MMA specifically are safe products to use when proper handling and safety procedures are understood and followed. Some of the aspects to keep in mind when applied as described below.

MMA is classified as a flammable liquid by U.S. D.O.T. It has a flash point of approximately 50°F, depending upon exactly which method of evaluation is used. Flash point is a term used to describe the temperature at which the vapour directly above a liquid, such as MMA, in an open container will ignite when exposed to a source of ignition.

To evaluate “how safe” MMA is, consider that gasoline has a flash point in the vicinity of –30°F, whereas most organic solvents used in industrial maintenance coatings flash at 0 to 40°F.

Another term to understand is the lower explosive limit or LEL. This is the percent of vapour in air which will result in an explosion when the mixture is exposed to an ignition source. For MMA, this value is 2.1% or 21,000 ppm. The allowable eight hour exposure limit listed by the Occupational Safety and Health Association (OSHA) and American Conference of Governmental Industrial Hygienists (ACGIH) for MMA is currently 100 ppm. In addition, most individuals can detect the odour of MMA at concentrations of 1 ppm or less. It is, therefore, understandable that a hazardous situation can easily be avoided due to the inability to tolerate high concentrations of MMA vapour at a given time. This acts as a safety mechanism when working with products such as Acrydur®.

Since MMA odours are easily detectable, precautions must be taken when working near sensitive materials such as foodstuffs. MMA is slightly soluble in water, and so items like meat, dairy products, etc. must be removed from areas in which Acrydur® is being applied. Cured materials are inert and odour free.

Any sources of ignition must also be prohibited in areas in which Acrydur® is present. This includes lit cigarettes, open flame heaters and the like. Containers should be ground when transferring Acrydur® resins.

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Regarding toxicity, MMA-containing products like Acrydur® are generally considered to be irritant. MMA has a distinct odour, easily discernible as described above, and is known to affect individuals in different ways. Typical side effects of exposure to this chemical have been known to include skin, eye and nasal irritation. An individual`s symptoms of exposure will diminish, however, when removed from the source of MMA such as a mixing station, etc.

As described in the document entitled “Toxicology of Methyl Methacrylate – Sponsor`s Communication Document”, found under the “SAFETY” section of your Acrydur® Applications Handbook:

“MMA is metabolized rapidly via the Kreb`s citric acid cycle and excreted speedily chiefly as carbon dioxide from the body. This is consistent with the low level of observed toxicity”.

This summarizes our overview of the health and safety aspects of Acrydur®. For additional information, we advise you to consult the other safety documents provided in your new Acrydur® binder. Please feel free to call us for any other questions you may have in the resins and other materials used in applying Acrydur® resurfacing systems.

Some Comments On The Cure Of ACRYDUR® Resins

As a class of resins, methacrylates utilize a different cure mechanism than their partners in the construction industry: Epoxies, polyesters, vinyl esters and polyurethanes. Our Acrydur® line of methacrylate resins, namely Acrydur® 112, 332, 418, 412, 510, 522, 526 and 528 are all two-component, 100% reactive materials. Two unique concepts to remember when handling these resins are (1) variation in hardener dosage and (2) air inhibition.

Hardener Dosage

Methacrylates cure with the addition of a hardener, most commonly 50% benzoyl peroxide powder. The amount of hardener used is temperature dependent, unlike the previously mentioned resins systems. Most of these materials rely upon a set resin to hardener ratio (A to B component) in order to chemically react and attain the highest degree of cure. The ratio is critical; an excess of one or the other component will significantly affect the performance properties of the coating or leach out over time. The pot life and cure time cannot be readily controlled; at high temperatures they are shorter, at low temperatures they take longer. There is often a minimum temperature required for adequate cure which can be a significant restriction for cold applications indoors or outdoors

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Methacrylates such as Acrydur® utilize the hardener to initiate the chemical reaction which links together the reactive groups in the methyl methacrylate (MMA) monomer and other molecules into a solid polymer. As it is only an initiator, the amount of hardener can be varied depending on the temperature of application. For high temperatures less is added, for low temperatures more is added. The result is a controlled pot life of 20-40 minutes and full cure in 1-2 hours over a wide temperature range. For Acrydur®, this can vary from –20°F to 100°F.

Granted, a specified amount of hardener is required for proper cure at these temperatures, normally 1-6% by weight of Acrydur® resin, but it is not a rigid requirement. Slight variances at a given temperature can be tolerated by the resins resulting in normal cure and performance characteristics. It must be understood , however, that this is not a feature to be abused, i.e. an extremely inaccurate resins hardener ratios will not produce optimum cure.

In order to maintain the cure window below 40°F, accelerator is added to the resins at 0.5-3.0% by weight. Accelerator B 101 is commonly used and must be added to the resin before the addition of a hardener. Once again, the amount is small and varies due to temperature.

This type of chemistry permits the use of fast, low-temperature curing resins in the construction industry.

Air Inhibition

Air inhibition is a phenomenon which also must be understood when working with methacrylates like Acrydur®.

When air, or more accurately oxygen, gets in direct contact with catalyzed resin, the polymerization reaction can be disturbed. The presence of oxygen may result in a partial cure of the resin producing tacky or soft surfaces.

This is due to the reduced reactivity of the hardener. When mixed with the resin, the hardener decomposes and begins to initiate the polymerization reaction which links together the MMA chains. In the presence of oxygen the initiator forms a more stable compound, thereby interfering with the polymerization reaction.

In order to prevent direct contact of the catalyzed resin with oxygen, special types of paraffin waxes have been included in the formulation of the various grades of Acrydur®.

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When applying a primer, basecoat or sealer, the paraffin rises to the surface and creates a vapour block, thereby eliminating the effects of air inhibition and allowing for optimum cure. The paraffin dissolves when the next layer is applied.

The formulation of the paraffin is dependent on several factors. Firstly, the materials should not be overworked once they are applied, so as to permit the paraffin layer to form undisturbed. Secondly, proper ventilation is required in order to provide for air flow over the coating during application and cure. Thirdly, at low temperatures the paraffin tends to settle out the formulated resin. It may be required to redisperse the contents of Acrydur® containers to ensure uniform amounts of paraffin when decanting.

Air inhibition can also be encountered when highly filled coating mixtures are prepared – e.g. trowel-on coatings based on Acrydur® 510 or Acrydur® 050/051. When improperly sized sands are added, the possibility of inhibition is great. Due to the high surface are of the fillers and resin-starved pockets which may result. The entrapped air impedes the above-mentioned reaction and detracts from the cure and ultimate properties of the coating. This also applies to the use of Aerosil 200– e.g. contained in Acrydur® 540 coving mixes. An excess amount of Aerosil easily leads to air inhibition; it is preferable to use a diminished quantity in combination with a longer mixing time to ensure a proper moistening of the Aerosil particles.

It is recommended to carefully select the fillers used for these mixes; please consult our **Guide Formulations** bulletin for additional details or feel free to call us with your specific questions.

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