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PLEASE NOTE: This series of documents deals with the safe handling of unsaturated polyester resins (UP Resins). For simplicity reasons, UP Resins is also used as an umbrella term to include gelcoats, topcoats, vinyl ester resins, bonding pastes, repair putties and other styrenated resinous products.

Safe handling of unsaturated polyester resins

Introduction

When producing composite parts, all component materials should be used correctly to avoid any adverse impact on the environment or human health.
Since unsaturated polyester (UP) resins contain styrene as the most important monomer, which is a flammable substance, these resins are therefore classified as dangerous goods and certain safety precautions have to be followed with regard to transport, storage and handling. This information sheet details the generally accepted recommendations for the safe handling of UP Resins and related products such as gelcoats, vinyl esters and bonding pastes.

General precautions

A Material Safety Data Sheet (MSDS) will accompany each delivery of UP resin. An MSDS provides essential information on important aspects concerning the safe handling of UP resins. Always read the MSDS carefully before starting to work with the product. If the content of the MSDS is not fully understood, consult your supplier for clarification. For the safe handling and use of UP Resins, strict precautions should be taken against:

- Flammability and explosion.
- Spillage.
- Contact with skin and eyes.
- Vapour emission inhalation.

Flammability

The flash point of styrene is 32°C, which categorizes UP Resins as flammable liquids. They should be treated as such, which means keeping them away from flames and other possible ignition sources. Smoking is prohibited at the unloading area and in any place inside the workshop. Fire extinguishers must be available and explosion-proof electrical installations are also required where resins are stored and used. The site must also be equipped with an emergency shower and facilities to rinse the eyes (e.g. an eye-wash station), as well as having all the protective equipment and clothing as specified in the Material Safety Data Sheet (MSDS). Ensure that your personnel are fully trained regularly in handling fire-fighting equipment.

Spillage

Storage tanks for UP resins should be placed inside an emergency pit, which has a capacity sufficient to hold the complete content of a full storage tank. When a spillage occurs in a tank unloading area, good access to the tank storage facility is important, and the unloading area must be equipped to collect spillage.
Drums of resin, intermediate bulk containers (IBCs) and pails should be stored in a facility with a liquid-tight floor in order to prevent any leakage to the ground water. The collected material must be disposed of in accordance with local regulations.

The spillage must be removed without contaminating the surrounding ground and a proper absorbent material such as vermiculite has to be available in sufficient quantities to take up any spillages.

Static Electricity

Static electricity can be generated when handling materials with low electrical conductivity, such as resins and glass fibres. Friction or contact and separation generate static electricity, and, if it's not discharged by proper earthing, static electricity can spontaneously discharge creating a spark of high voltage - especially at a low level of air humidity. Wherever flammable liquids or gases are present the potential for fire is high, so avoid conditions that could cause static electric discharge.

Precautions need to be taken during spraying to avoid static build-up

In processing UP resins, static electricity can be generated by various sources:

- A fluid being pumped through a spray gun hose can build up static electricity because of friction, - the same applies to fluid exiting the spray tip. It is therefore essential that such fluid handling equipment is properly earthed. Electrical conductivity must therefore be established from the body of the spray gun, through the fluid hoses to the pump and to a known ground. Check with your equipment supplier for specific procedures to establish the proper earthing.

- When using so-called flow choppers the generation of static electricity may be higher than with the traditional spray guns. In these cases it is even more important to create proper electrical conductivity and earthing of the equipment.

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Surface charge on mould surfaces is another well-known phenomenon. It can be seen by the formation of dust stars on the surface and static electricity discharge (static sparking) when demoulding a part. When using non-conductive moulds, static electricity will only discharge from a local area, so not creating the larger surface charge bleed-off. With conductive surface moulds however, the entire mould surface will discharge in one contact thus providing greater potential for high voltage discharge. When an operator comes close enough the entire mould surface will discharge suddenly. So, conductive surfaces must be earthed to prevent hazardous static electrical discharge.

- Static electrical build-up by non-conductive glass roving passing through roving guides and choppers can also create a problem. To reduce potentially hazardous discharges, always use ceramic roving guides. Earth the overhead boom and be sure that the chopper is properly grounded to the spray gun.

General advice

To reduce the likelihood of a hazardous discharge of static electricity, avoid low humidity in the workshop by keeping the relative humidity above 50%.

Use ionized compressed air for cleaning mould surfaces. This will neutralize the danger of a possible surface charge in the mould. Subsequent rubbing of the mould surface when waxing and polishing will create a charge, so it should be repeatedly treated with the ionized air during the waxing procedure.

Good Housekeeping

Safe usage is also a matter of good housekeeping, providing good working conditions, cleanliness, ventilation, plant layout and correct protective clothing, as well as eye and respiratory protections. Provide continuous employee training in safe working procedures and practices. Avoid skin contact and maintain strict cleanliness and good housekeeping.

Minimize contamination of the working area by placing disposable paper or solvent resistant film on tables and floors - which should be removed at least once a day or immediately after a severe spill. All spilled waste, contaminated cleaning paper and rags should be disposed of in a separate fireproof container situated outside of the factory.

Prevent contact with vapours by providing sufficient ventilation of the working area, and by using approved respiratory protection.

Ensure that dust from finishing operations is kept under control by collection devices and by effective ventilation.

Environmental risks of styrene

Styrene is readily biodegradable, so there will not be a major environmental risks if styrene enters the soil and groundwater or is evaporated into the air. The recently published text from the environment section of the styrene risk assessment, confirms that styrene quickly breaks down into components that do not harm the environment.

In groundwater and in soil, styrene is broken down rapidly into harmless chemicals. Styrene also rapidly degrades in the atmosphere due to the presence of UV light. Nevertheless, the emission of styrene can be subject to a number of national or local regulations, so it will always be important to reduce the emission of styrene into the environment as much as possible.

Occupational exposure to styrene

The occupational exposure to styrene is strictly regulated in every country. In most countries a Maximum Allowable Concentration (MAC) or Threshold Limit Value (TLV) has been established which states the maximum concentration in the workplace atmosphere, to which a worker may be exposed during an 8 hour working day (see Technical Bulletin 3). The exposure to styrene should be minimized where possible by using proper ventilation in the workshop.

Always wear the correct safety equipment when handling hazardous materials and decant away from the production area to limit solvent emissions.

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The inhalation of styrene vapour should be avoided, if necessary by using personal respiratory protection. Prevent resins coming into contact with skin and eyes, by wearing appropriate safety clothing such as gloves, coveralls and goggles.

Decanting and mixing of UP resins should be carried out in a separate well-ventilated room, to reduce the likelihood of styrene vapours drifting into adjacent working areas.

Follow the manufacturer's instructions when mixing and blending additives, accelerators, fillers and peroxides. Being reactive materials, certain additives or combinations of additives can cause unwanted reactions.

Residual catalysed resin products in containers can cause self-ignition due to high temperature build-up (exothermic reaction) during the curing reaction. Pails and buckets with residual catalysed resin products should, therefore, always be removed well away from the working area, and placed a safe distance from other ignitable materials (ideally outside and a safe distance from buildings and other combustible materials). If the buckets are topped up with water, this will absorb much of the temperature build up of the polymerisation reaction.

Waste handling of UP Resins and products made of UP Resins

Styrenated resin products are regarded as special waste in many regions, and must therefore be handled according to local rules and regulations. UP resin waste should preferably be cured before being disposed of. The curing process of such waste must be done in a controlled way, to avoid self-ignition. Only cure a controllable volume in each container/pail and add no more than the recommended volume of peroxide and possibly accelerator, to prevent it curing too quickly with too high an exotherm. The curing system must be thoroughly mixed into the resin.

Once the curing starts it is recommended that the container is flushed with cold water to control the reaction. Polyester resin products will self-ignite if the resin temperature reaches approximately 480°C. When cured and cooled, the waste can, in general, be treated as non-hazardous waste.

Waste of other styrenated products and additives, such as low profile additives, fire retardant additives and pigment pastes, can be mixed into resin/gelcoat waste in lower volumes. These will then cure into the system when adding accelerator and peroxide.

Safety First

- ✓ **In the event of an accident, always consult the relevant MSDS for specific health and safety information on the material/s in question**
- ✓ **Always consult your local authority or environmental officer for proper guidance on safe disposal**
- ✓ **Never mix together organic peroxide and accelerators as this will cause an explosion**
- ✓ **Always keep organic peroxide in a separate fireproof store away from direct sunlight or other heat sources**

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