



SP Systems
Composite
Engineering
Materials

General Health & Safety advice for SP Systems Epoxy Resins & Hardeners

Introduction

SP Systems epoxy resins, hardeners, and other products are high performance materials. They are a complex blend of chemicals specially selected to give each system its desired characteristics. At SP Systems we are concerned that our customers can use our products safely, and therefore we have developed this document using our own expertise, knowledge and experience, together with advice from consultants in the fields of both occupational hygiene and the prevention of occupational skin disease.

As with any chemical, poor handling or misuse could be potentially hazardous to health, therefore it is essential that the appropriate safety procedures are observed when using these products. This document is intended as a general guide to the safe use of epoxy resin systems and the recommendations contained in this guide should be followed when using SP Systems products. Materials Safety Data Sheets are available for each hazardous product supplied by SP Systems.

Resins & Hardeners

Epoxy resins and hardeners, by their nature, contain chemicals capable of causing damage to health. However, if these products are used with appropriate care and control, the risk should be minimized. It is important to recognise that a chemical can only cause damage to health if there is exposure, i.e. contact between the user and the chemical. If there is no contact then there can be no interaction between the user and the chemical and no damage to health. Thus the basic rule in the use of all chemicals is the avoidance of contact, or at least its limitation to a level where the risk of damage to health is minimal.

Each component part, resin or hardener, will have hazards associated with it. The resin can be harmful to health by inhalation, and, in contact with the skin, it can cause irritant contact dermatitis and allergic reactions. Epoxy resins are also known to be skin sensitizers. The hardener is usually classed as a corrosive, and as irritant when in contact with the skin or by inhalation.

Once fully cured an epoxy system is essentially inert and non-hazardous.

Explanation of Terms

Dermatitis - there are two types, irritant and allergic.

The **irritant** reaction occurs where the chemical damages the skin directly at the point of contact. The damage may not be immediately apparent, but if the exposure is repeated it may result in an accumulation of damage until the skin can no longer tolerate any further exposure. The result is that the skin can become inflamed,

itchy and often a red rash with cracking and blistering appears. If the exposure is minor the skin will heal when the contact is removed. However extensive contact may cause more severe damage.

The **allergic** reaction involves an overreaction of the body's immune system, which, once triggered, tends to be a long term or permanent effect (see Sensitisation). The symptoms only appear when there is exposure to the trigger chemical and once exposure is removed the symptoms recede as the body recovers. The onset of symptoms is usually very quick - seconds or minutes. The symptoms may be apparent over the whole body, which can manifest in a similar way to irritant reactions. It is not possible to determine in advance why a particular person may be affected as, in common with most allergic reactions, it is an individual intolerance to a particular material.

Sensitisation - this is a process by which a person exhibits a reaction to a particular material but only after a period of repeated contact. Once the allergic reaction has been established then even a low level of brief repeat contact will trigger the reaction. The symptoms will usually appear as a rash of varying coverage, intensity and discomfort. The time period between first contact and subsequent development of sensitisation, causing the rash to appear, can vary from days to years.

This is a highly individual problem. Some workers will be able to handle so-called 'sensitisers' for years with no effect. Some will react almost immediately and others may only show the reaction after having handled the material for many weeks or months. Sensitisation can occur through skin and respiratory contact.

Corrosive - certain chemicals are classified as corrosive which means that they damage or destroy living tissue on contact. Typically, the effect will be seen as redness and blistering of the skin.

Solvents and Solvent Based Systems

Some of SP Systems' products are solvent based and working with these can present particular hazards due to this solvent content. Inhalation should be avoided as the vapours can lead to nausea, headaches, and in serious cases loss of consciousness. Adequate ventilation must be ensured and work in confined spaces limited as solvent vapours are harmful and can be flammable above certain concentrations. Skin contact should be avoided as solvents can help induce dermatitis by removing the natural oils which are the skin's protection. The washing of hands in solvents is not recommended and is a major cause of skin problems.

Filler Powders

These tend to be very light and are easily carried into the air. They are primarily irritant by inhalation and in contact with the skin and eyes. Care should be taken when mixing these powders into resin systems and good hygiene practices observed.

Fibres and Reinforcements

SP Systems sells a range of materials including carbon, aramid (Kevlar™ or Twaron™) and glass fibre. If good hygiene practices are followed the health risk from using these materials is low. There are various factors to take into consideration.

Carbon fibre is electrically conductive and free floating fibre in the air can be drawn into electrical equipment which has the potential to cause short circuits. All of the fibres can be an irritant to the lungs, skin and eyes and suitable protection should be worn when using and particularly when cutting these materials.

Prevention of Exposure

By preventing contact and exposure to hazardous materials it is possible to control and minimise the risks to health. This should be done in a structured manner through the use of engineering controls (such as enclosure of the process), ventilation, training, and the use of Personal Protective Equipment (PPE).

Enclosure - in an ideal situation all work using hazardous products would be carried out in an enclosed environment with the operator isolated from the chemical. However, practically, this is difficult to achieve, particularly with the materials used in the manufacture of composite components. This being the case more reliance must be placed on ventilation and PPE.

Ventilation - as a significant amount of exposure can be from airborne materials in the form of fume, vapours and dusts, it is important that a good level of ventilation is maintained. The level of ventilation depends upon the task being undertaken and may vary from general background, as in a well aired workshop, to specialised facilities to provide general and / or local exhaust ventilation through forced extraction systems. The design of such systems can be complicated and specialist knowledge is often required.

Training and awareness - it is important that those who work with hazardous materials are informed of the hazards and risks associated with the products and processes. SP Systems produces Material Safety Data Sheets for all of its hazardous products which contain detailed information on the product.

Personal Protective Equipment (PPE) - an important part of working safely with composites, PPE takes several forms.

Gloves - the industry standard is the disposable latex type. These, while being freely available and inexpensive, do exhibit certain problems during use. They offer relatively poor chemical resistance, particularly to solvents, and are easily torn. An increasing problem is allergic skin reactions due to sensitivities to proteins found in natural rubber latex, and the powdered variety cause the most concern as the powder can exacerbate the skin reaction. The

related problem of hypersensitivity to latex should also be considered due to the possible seriousness of the reactions.

As a result of all of these factors SP Systems recommend the use of disposable Nitrile gloves for most applications. This type of glove has a number of advantages over the latex variety, including greater tear resistance and no latex allergy.

It should be emphasised that gloves are regarded as offering splash protection only and direct contact with chemicals is to be avoided. For use with solvents a heavier duty type of glove is recommended to give additional protection but as solvents are usually quite aggressive to glove materials it is advisable to ascertain what type of glove is best suited to the particular solvent used.

Eye safety wear - this can take many forms and correct selection is important. For operations such as sanding a pair of goggles would be advisable to prevent ingress of dust. For most other operations a pair of safety spectacles will suffice.

Overalls - when working with epoxies it is important to prevent skin contact, so long sleeved overalls that offer a good level of protection should be used. If they become contaminated, and there is a possibility of the contamination soaking through to undergarments and the skin, overalls should be removed immediately. Regular washing of overalls is advisable.

Respiratory protection - it is important that adequate levels of ventilation are maintained when using epoxy resins. Inhalation is a primary route of entry for chemicals into the human body and must be prevented as far as possible. Good general and / or local exhaust ventilation should be considered before turning to respiratory protection. If workplace conditions are such that it is difficult to achieve a good level of ventilation then respiratory protection is an option. There are two types of protection available. For low levels of fume a face mask conforming to BS EN 141 (organic vapour) is recommended. This will not protect the wearer against higher concentrations of fume - in these conditions an air fed mask with an independent air supply may be necessary. It is important to consider the risks of working in confined spaces with high concentrations of fume as the atmosphere may not be respirable.

Routine Safety and Protection

Skin care - SP Systems continually reviews latest advice and best practice from experts in the field of occupational health and skin care. As a result we now do not recommend the use of barrier creams, as their effectiveness as a protection against epoxies and solvents is dubious and they may induce a false feeling of security. Correct glove selection should give sufficient protection.

Skin is a semi permeable covering for the body. It performs many functions such as controlling temperature, retaining body fluids, etc., but its primary function is to act as a barrier. It will, however, allow the absorption of materials from the environment and it is important to recognise this when using hazardous products. If the skin becomes contaminated then the contaminant must be removed immediately using an appropriate hand cleaner.

Hand Cleaner - the selection of hand cleaner should be the most mild that will effectively remove the contaminant, and therefore a range of special resin removing cleansers are available. The use of solvents as a method of removing resins should be forbidden as solvents damage the skin and can be absorbed and enter the bloodstream. After applying the hand cleaner, the hands should be washed in tepid running water, properly dried and then an after-work conditioning / moisturising cream should be used. This use of an appropriate cream is important as it helps to replace the natural oils that are removed by the washing process. The natural oils are one of the skin's defence mechanisms against attack and the maintenance of good skin condition is instrumental in preventing skin diseases.

Hygiene practices - a routine of washing must be established, before eating, drinking or smoking, before using the toilet, and after finishing work. The danger is that if good hygiene is not practiced then it is possible to inhale or ingest small amounts of chemical with a possible risk of cumulative effects.

Food and drink must not be consumed in the work area. Smoking while working should not be permitted for several reasons including the transfer of contaminants from hand to mouth, and the effect of drawing gases and vapours through the burning tobacco which may increase the level of hazard, with the subsequent impairment of the lungs' ability to deal with small particle contamination.

In warm work situations perspiration can be a problem. When the skin perspires the pores open and the moisture present on the skin surface can make the skin more sensitive. This is a potential problem particularly during sanding operations. Until a resin system is fully cured it retains most of the hazardous properties of the pre-mixed products. Dusts that are produced should be controlled, possibly by extraction, and appropriate Personal Protective Equipment such as gloves, overalls, respiratory and eye protection should be worn. Wherever practical, wet sanding is preferable. If the sanding dust settles on the skin, or becomes trapped between the skin and PPE then irritation can occur. Jewellery and watches should be removed before work commences, and frequent washing and showering is advisable.

It should be realised that if the temperature of the resin system is raised to reduce viscosity or shorten gel times then more volatiles and fumes may be released into the workplace than would be seen at normal temperatures.

Workshop Practices

Handling - when mixing or dispensing SP products care must be taken to avoid contact with eyes, skin and by inhalation. These operations should be carried out in a well ventilated area.

Storage - lids for the containers should be replaced immediately after use, and products should be kept in their original containers which are correctly marked and bear the appropriate hazard labels. The labels should be kept clean and intact.

Storage should be in a cool, dry, secure place. Accidental spills should be absorbed using sawdust, cotton waste or other propri-

etary absorbents. Contaminated absorbents and the empty product containers should be disposed of correctly.

Disposal - SP Systems has introduced a range of approved containers, predominantly in metal, which are designed with recycling in mind. Some of the containers are fitted with disposable liners to facilitate the disposal process, minimising the amount of hazardous waste and maximising the possibility of easy recycling of clean metal containers. Spillages of filler powders should be removed by vacuuming.

General - heating for workshops should be carefully considered, as with solvent based systems and use of solvents in the workplace generally there is the potential for sparks from electrical equipment and tools to create a fire risk. If vacuum pumps or curing ovens are used in processing then the exhaust should be vented outside the working area.

Exotherms - An exotherm is an uncontrollable reaction between a solvent-free resin and hardener, which happens when the heat generated by the resin-hardener reaction cannot escape readily. The trapped heat accelerates the reaction which in turn generates more heat and further accelerates the reaction until it becomes uncontrollable. This normally happens only in bulk mixes, as mixed resin applied to a job is usually in a thin film (e.g. coating, glue line, laminate layer, filler layer, etc) from which heat readily escapes.

Causes of exotherm are usually a combination of the following circumstances:

- Mixing a large volume of resin / hardener and not transferring to a tray with a large surface area.
- Not using the mixed materials quickly enough, particularly if it is a 'fast' resin / hardener system (gel time 5-20 mins).
- Higher than normal ambient temperature, or components and / or mixed material left in direct sunlight.

The appropriate methods of working should be used to reduce the likelihood of exotherm. Systems designed to be applied in great thickness have formulations whose chemistry does not generate large volumes of heat (and therefore such systems are often slow curing).

If an exothermic reaction between the resin and hardener occurs then the container should be removed immediately from the workshop. The best way to deal with an exotherm is to immerse it in water which cools it and reduces the volume of fumes produced. The fumes are noxious and should not be inhaled. To extinguish burning epoxy material the correct media is Carbon Dioxide, Dry Powder, Foam or a Water fog. Do not use a full water jet.

Accidental Contact

After Skin Contact - Remove contamination from the skin with tissue or paper towels. Any material left on the skin should be removed with resin removing cream and the area washed with soap and warm water.

After eye contamination - The affected area should be flushed with copious amounts of eyewash and medical attention sought.

After Ingestion - In the unlikely event of this occurring the mouth should be rinsed out with water and immediate medical attention sought.

After Inhalation of Fumes - Remove the affected person to fresh air and seek medical attention.

When seeking medical attention it is advisable to take the product MSDS to the medical practitioner to assist in treatment.

Notice

The policy of SP Systems is one of continual development and improvement. In compiling this guide advice has been sought from Occupational Hygienists and Occupational Skin Specialists together with the in-house expertise of SP Systems.

Any information contained within this publication or obtained from SP Systems by other means is given in good faith with the intention of aiding users to work in a safe manner. However, as SP Systems cannot have direct knowledge or control over the individual conditions where its products are used we cannot accept any liability or damage as a result of the information given.

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