SURFACE PREPARATIONS
For durable adhesive assembly

INTRODUCTION

Whether for construction or industrial assembly applications, surface preparation plays a key role in an adhesive assembly. It becomes indispensable in critical or structural applications. Surface preparation changes the nature of the interface. That's why this document presents the different surface preparations possible, depending on the materials or substrates used. This document is intended as a summary, and in no way precludes the mandatory tests required for any adhesive assembly. As each application has its own specific requirements, we will be happy to support you in choosing the best possible surface preparation and the most appropriate adhesive for your application.

IMPORTANT DEFINITIONS

Interface: new entity formed when adhesive and substrate come into contact. The interface plays a very important role in an adhesive assembly. Adhesive failure is often due to a problem at the interface. For more information on types of failure, see our document: Sealants and Adhesive Failure Types

Wettability: the ability of a solid surface to receive a liquid, allowing it to spread completely over the largest possible surface.

Surface energy: the surface energy of a material is its ability to be wetted by a liquid (adhesive). The lower the surface energy, the more difficult it will be for the adhesive to create good wettability; the higher the surface energy, the easier it will be.

Measuring surface energy and wettability: There are two ways of measuring surface energy and wettability:

1) Dyne ink: set of inks with a Dyne/cm (or mN/m or mJ/m^2) of 22 to 60 (may vary depending on the set chosen) enabling surface energy only to be measured. The accuracy of these inks is questionable, as the data collected is highly subjective, depending on the user.
2) Contact angle and surface energy measuring devices (surface analyzers): these once costly and bulky devices have been replaced by portable and highly versatile ones (they adapt to surfaces of all shapes and sizes). They not only measure the contact angle of a liquid, but also the surface energy of a solid, with the utmost precision.

IMPORTANT: Surface energy and contact angle provide us with essential data for the most appropriate choice of surface preparation required according to the choice of materials for an adhesive assembly.

CLEANING (DEGREASING AND/OR MECHANICAL)

Cleaning removes almost all undesirable contaminants that can interfere with adhesion. Cleaning should always be an integral part of an adhesive assembly.

Non-porous surfaces

All non-porous surfaces should minimally be cleaned with ADSEAL CLEANER 6003 using the 2-clothes method. Transfer a reasonable amount of cleaner into a container to avoid contaminating the main container.

Wash surfaces with the first cloth dampened with cleaner, then wipe with the second clean, dry cloth before the solvent evaporates. Change cloths regularly to avoid dirt build-up. Avoid soaking a soiled cloth in clean solvent to avoid contaminating it. Choose white cloths that won't trap dust or leave lint on substrates. Be sure

SURFACE PREPARATIONS
For durable adhesive assembly

to clean all surfaces that will come into contact with the adhesive. Adhesive should be applied within an hour of cleaning to avoid surface contamination. If the application is made more than one hour after, repeat cleaning. Avoid using detergents or any other cleaning products not specified by ADFAST. Allow sufficient time for the solvent to evaporate before applying the adhesive.

Abrasion (sanding, grinding, etc.) may also be suggested on certain metallic or plastic materials to create porosity, which may in some cases improve adhesion. These must be followed by solvent cleaning as described above. In the case of materials heavily contaminated with grease or oil, we recommend degreasing before and after abrasion. In certain assemblies requiring very high adhesive forces, alumina sand blasting may be an option. Different surface preparation methods can be combined to achieve the desired results.

Porous surfaces

Porous surfaces must be prepared mechanically (by abrasion), after which the dust must be removed completely with an oil-free air compressor. Porous surfaces include the following materials:

- Masonry products: Grinding is the most suitable surface preparation for all masonry products, especially during renovation work (contamination of old adhesive or sealant). It's the most optimum way to return to the original surface. Grinding also removes any unwanted mortar burrs or other contamination in the case of new construction.

  An oscillating tool with a diamond blade can also be used, except in the case of refurbishment. A steel brush can be used on surfaces with very little contamination, or with very slight mortar burrs in the case of new construction only.

- Wood product: solid woods should ideally be edged with twin blade board edger with well-sharpened blades. A poorly sharpened blade will burn the wood fibers and close them up, creating an inadequate surface for optimum wetting of the adhesive. Sanding or planing wood is also a good way of preparing it for adhesive bonding.

  ATTENTION: oily woods such as cedar or teak must be prepared just before adhesive assembly to prevent the oils, they contain from rising to the surface and contaminating the adhesive (especially water-based glues).

  Wood-based materials such as plywood, particleboard, etc. can be prepared minimally by blowing out the dust with an oil-free air compressor, and in some cases sanding may be necessary. All wood and wood-based products must be free of all contaminants (oil, grease, etc.).

- Exterior Insulation and Finish System (EIFS): this substrate consists of an acrylic base coat and topcoat. In order to prepare this surface with as little damage as possible, the use of a brass brush is recommended, but with great care so as not to affect the visible surfaces.

- Plastic foams: these include upholstery foam such as polyurethane, latex, etc. as well as insulation board like EPS (expanded polystyrene), XPS (extruded polystyrene), PU (polyurethane) or PIR (polyisocyanurate). Blow off any dust with an oil-free air compressor. These plastic foams require no further surface preparation, but must be free of all contaminants (oil, grease, etc.).

- Cardboard and paper: Blow off all dust with an oil-free air compressor. These materials require no further surface preparation, but must be free of all contaminants (oil, grease, etc.).

SURFACE PREPARATIONS
For durable adhesive assembly

PRIMERS (CHEMICAL CONVERSION)

Depending on the materials/substrates and adhesive chosen, the use of a primer may be necessary to create an environment conducive to good adhesion (modification of the interface). Priming not only improves initial adhesion, but it can also accelerate adhesive curing and extend assembly lifespan, especially in the case of assemblies subject to fatigue stress (repeated movement and resistance over several life cycles). For more information on our primers, please consult the ADSEAL PRIMER Guide.

Beware of solvent-based primers when used near plastic foams, as they may melt them.

CHEMICAL ABRASION (CHEMICAL DEOXIDATION)

This process is used on metals such as aluminum. Mill-finished aluminum has an oxide layer which may sometimes require the use of a primer with a certain adhesive. When assembling large surfaces of untreated aluminum, the use of a primer may be undesirable, as it is not only very costly, but also requires a large amount of solvent (90 to 98% of primer is solvent). In such cases, chemical abrasion can be considered. This operation creates a new, controlled oxide layer. Of course, this step can only be performed by the mill that manufactures the aluminum or by a transformer. Often, companies who make anodized aluminum can only perform the chemical deoxidation that is an integral part of the anodizing process. Given the risk of contamination when machining certain parts, it may be necessary to degrease them before assembly.

ANODIZING

Anodizing is an electro-chemical process that makes aluminum durable and corrosion resistant. This process also facilitates assembly with various types of adhesives, often without the use of a primer. This process does not preclude the need to degrease aluminum before adhesive assembly, especially in the case of structural applications.

SURFACE ACTIVATION

Surface activation treatment is particularly effective for non-polar plastics such as polyethylene and polypropylene. Surface activation treatments include corona, plasma, and flame treatment. All these treatments serve to increase the surface energy of low surface energy (LSE) substrates, so the dyne increases, and the contact angle decreases, creating a suitable environment for optimum adhesion. In some cases, they enable a substrate to go from a non-polar to a polar state, which substantially increases the quality of adhesive bonding. All these treatments also act as cleaners, as they can destroy almost all possible contaminants on the surface of materials.

- Corona: an electrical process that generally requires a voltage of 10 kV or, in the case of the chemical (gas) version, 6 to 8 kV. This equipment is more difficult to adapt to certain production processes. It is normally made by an extruder and has a service life of 3 to 6 months. So don't keep too high an inventory. This treatment is ideal for laminating panels measuring approximately 1219 mm by 2438 mm (4' x 8').
- Plasma: Plasma is the electrical ionization of a gas. The voltage used is much lower than that of corona treatment. It can treat surfaces from 12mm (0.5'') wide or more. It can be adapted to a robot and easily used on a production line just prior to adhesive application. It is most effective on certain materials that

SURFACE PREPARATIONS
For durable adhesive assembly

are more difficult to process and can also be used on materials with a thickness greater than 3.2 mm (0.125'').

- Flame: this treatment works very well when automated (robot) and used with a gas/oxygen mixture (with excess of oxygen). However, this mixture must be precisely adjusted to ensure effective treatment. Its shelf life is very short, and the adhesive must be applied as soon as possible after flaming. This treatment can be carried out manually, but involves a high risk of fire, burning or distortion of the material. Moreover, when it is done manually using only gas, it is impossible to adjust the mix. At this point, the inner part of the flame (primary cone or hottest part) must be used. The flame must pass over the surface to be treated in less than a second, otherwise distortion will occur.

CONCLUSION

As we have seen in this document, surface preparation plays an essential role in the success of an adhesive assembly project. In most cases, adhesive failure is due to poor surface preparation. ADFAST's adhesion specialists can support you throughout your new projects, help you improve an existing adhesive bonding process, or advise you on other possible surface preparations.