

WMRC Factsheet

Paint Removal Options

The problem with paint is that it doesn't last forever. Eventually it may begin to peel, blister, or flake and before applying new paint it has to come off. With organic solvents falling out of favor and concern rising for the disposal of the hazardous wastes produced by paint stripping, industries must look at other ways of removing paint. This factsheet gives an overview of removal methods that reduce or eliminate the use of solvents, particularly methylene chloride, both for field and immersion stripping.

For Field Stripping

Use of Non-painted Surface Materials

Not painting in the first place completely eliminates the need to strip. The applications for this are case-specific; currently some airline, like US Air and American Airlines, do not paint their airplanes. The cost reduction is offset by increased maintenance for buffing and polishing to prevent corrosion.

Abrasion Stripping

Everything from sand to walnut shells have been used to strip away paint. As harder materials can damage metal, viable alternatives to chemical strippers used in industries like aircraft contractors are relatively soft materials.

Plastic media blasting (PMB) used tiny plastic pellets to abrade paint. After each blast cycle, 90 to 95% of the pellets can be reused. PMB is cheaper and quicker than chemical stripping. However, protective equipment is required because it releases large amounts of dust, dust that is potentially explosive. Other possible concerns are that PMB may cover fatigue cracks at high blast pressures and prevent their detection, and can stress existing cracks, causing them to grow. There is also a risk of dust entering the interior of airplanes, which requires better masking of potential points of entry. The U.S. Air Force and airlines have found PMB

effective for aircraft stripping, but PMB could also be used to strip vehicles, ships, and engine parts.

Sodium bicarbonate is another media used to remove paint. About 150 to 200 pounds of bicarbonate is needed per hour, while PMB requires 800 pounds. Overall, it is cheaper than PMB because it doesn't generate large amounts of waste. Neither is it prone to damage metal. It can have some long-term corrosion effects because alkaline compounds remaining on the metal can foster corrosion or interfere with the paint bonding. Corrosion inhibitors can be added; the waste may then become hazardous, depending on the type.

Dry ice (carbon dioxide) has the advantage of producing no waste other than the paint because it evaporates afterwards. However, McDonnell Douglas found that it can damage aircraft skins and that its rate of stripping is low.

More effective than all of these is wheat starch blasting. It doesn't damage metals at all, though it hasn't yet been determined whether it hurts composite materials.

Other methods are also available for other purposes. The Illinois Department of Transportation uses steel grit as an abrasive stripper on joints when, for example, stripping bridges. The grit can be reused. The department also uses power tools to strip paint, along with vacuums to keep dust at a low level.

Thermal Stripping

Two possible alternatives to solvents are CO2 lasers and high intensity quartz lamps. In each method, the surface absorbs so much energy the paint blows off the surface. With the laser, the residue is vacuumed up as it is removed; in the latter, the black residue can be wiped away with a rag. McClellan Air Force Base projected a five-year savings of \$1.66 million from

using high intensity lights instead of chemicals. Areas of concern for thermal stripping are the toxicity of the breakdown products and possible effects of lasers on the metal.

For Immersion Stripping

Abrasion Stripping

For immersion stripping, the common media are PMB, glass beads, molten salt baths, and ovens.

In the first, an air stream is pumped into a tank of quartz sand or aluminum oxide, making it a fluid. Natural gas is mixed with the air and ignited above the tank, creating temperatures of about 800°F. Objects to be stripped are lowered into the tank in a basket. The paint is vaporized. The gases and unburned natural gas are burned in a post-combustion chamber above the tank. A wet scrubber removes the solids from the final exhaust before it is vented into the air. This method works for steel parts, but not aluminum because of the high temperatures.

Molten salt baths remove paint easily from metal. Baths that are only 500°F to 700°F significantly reduce any problems with heat distortion. Objects to be stripped are lowered into the salt bath, removed and rinsed with water, then dilute acid, then water again. Care must be taken in stripping aluminum parts; more than 60 seconds in the bath could soften the metal and make the parts unusable. Also salt can solidify or get trapped in an area that cannot be thoroughly rinsed, causing corrosion later on.

Ovens simply burn the paint off. Like the fluidized bed, this method is limited to steel parts.

Water-Jet Blasting

The automotive industry currently uses high pressure water-jets to remove paint from the floor of painting booths. Water-jet blasting is feasible for removing paint in other situations, but there are still unresolved questions about control and reliability of the system, potential surface damage, worker safety, and which paint coats water-jets can remove.

Cryogenic Stripping

Objects are either dipped in or sprayed with liquid nitrogen. The paint contracts more than the metal does, causing it to crack. Cryogenic stripping does not

remove epoxy and urethane coats as well as other kinds of coats, nor is it as efficient at removing thin coats as thick ones. Cryogenic stripping has a limit of 400 pounds of parts in the chamber in any one stripping cycle. Like thermal stripping, this method can damage or distort parts because of the extreme temperatures.

Biodegradation

This is still in the experimental stage. One method is to create microorganisms that feed on polyurethane-based paint. This method works, but only very slowly. Another approach is to make paint itself more biodegradable by adding cellulose and elastin. However, that could decrease the life span of paint and require more stripping rather than less.

Alkaline or Acidic Strippers

Alkaline strippers leave a residue on parts because they can't remove paint completely. They are effective on gum varnishes and phenolics, but not epoxies. They can degrade some metals, like aluminum, but can be used on steel.

Acidic strippers attack metal. Solvents such as alcohols or glycol esters can be added to inhibit metal attack and to make the strippers easier to work with.

Both of these must be heated to be effective, and both are suitable mainly for immersion stripping.

Hot Caustic Strippers

This method dips parts to be stripped in a caustic bath at over 200°F. Caustic baths are limited in the kind of coats they can remove; epoxies, for example, resist both heat and caustics. Only steel parts can be dipped in the bath because the strippers will corrode many kinds of metal.

Alternative Solvents

There are many substitute solvents based on N-methyl-2-pyrrolidone and dibasic esters. However, they can have one or more of the following problems: increased stripping time necessary, flammability or combustibility, must be heated to be effective, have compounds with unknown health and environmental effects, or photochemical reactivity.