MODERN ROOF REPAIR WITH PSA TAPES

BY CHRIS MARGARITES

It all began with a torn RV roof. While pulling into our campsite back in September of 1998, I came too close to the branch of a big oak tree, dragging it across the thin white EPDM roof and instantly tearing a large hole, leaving the plywood underneath exposed. I was horrified! Storm clouds were rolling in, and after 23 years as a mechanical contractor seeing firsthand the complexity of patching and repairing single-ply roof systems such as EPDM, I knew there was no answer for me at the local Kmart. Fortunately, the clouds blew by, and we were spared the rain that night.

I returned home and called the manufacturer of the RV, who put me in touch with the manufacturer of the rubber roof, and the latter promptly sent me a repair kit. I expected to find a sophisticated, hard-to-get repair system. Instead, what I received was a piece of white rubber, cleaner, primer, glue, and a tube of butyl lap sealant. I was grateful for their generosity but apprehensive about the solution. I knew there had to be a better way, and I set out to find it.

In my search, I learned that each single-ply system has its own multistep repair protocol that requires specific skills, training, tools, and materials. I also saw an opportunity. I reasoned that if I could develop an easy-to-use, self-priming, long-lasting, no-waste repair product (preferably in a tape form) that could be used at virtually any

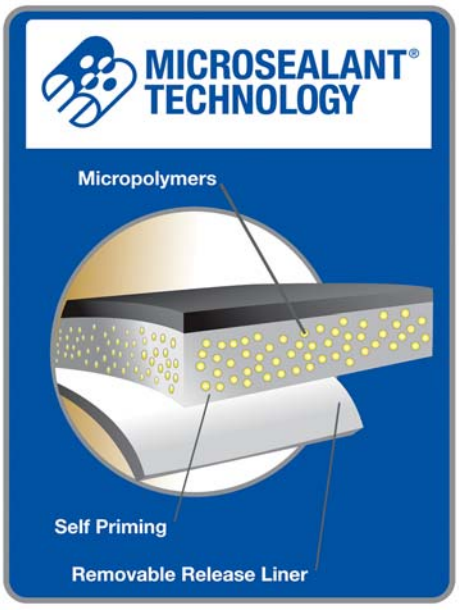

Figure 1 — Exploded view of a microsealant.

MICROSEALANT
TECHNICAL DATA COMPARISON CHART
TYPICAL TAPE PROPERTIES

	EternaBond MicroSealant	Butyl	Bitumen	Asphaltic
Life Expectany	18 – 35 years	< 10 years	< 5 years	< 5 years
Warranty	10 years	–	–	
Shelf Life	5 years guaranteed	–	–	–
Short-term contact with solvents or non-cured solvent based products	OK	Avoid	Avoid	Avoid
Ponding Water	OK	Avoid	Avoid	Avoid
Low Temp. Application Limit	-20ºF (with primer)	+25ºF (with primer)	50ºF	50ºF
Ozone Stable	Yes	No	No	No
UV Resistant	Yes	Yes	No	No
Self Priming	Yes	No	No	No
Tensile Strength	45N	10N	10N	10N
Petroleum in formula*	No	Yes*	Yes*	Yes*
MicroSealant™ Technology	Yes	No	No	No
Available in widths up to 48"	Yes	?	?	?
Long term adhesion to:				
EPDM	Yes	Yes (with primer)	No	No
TPO	Yes	No	No	No
Hypolan	Yes	No	No	No
Aged PVC	Yes	No	No	No
Modified	Yes	Yes	Yes	Yes
Treated Lumber	Yes	Yes	No	No
Polycarbonate	Yes	No	No	No
Polyethylene	Yes	No	No	No
Polypropylene	Yes	Yes	No	No
Vinyl	Yes	No	No	No
Fabric	Yes	Yes	No	No

* Petroleum Distillates are typically used in the formulation

Figure 2 — PSA tape comparison chart. Courtesy of chartered chemist Bertram Barnswell, PhD, MACS, MCIC.

temperature and on any surface (especially sophisticated single-ply roof systems), I would really have something. I further reasoned that it had to be environmentally friendly, have a long shelf life (at least five years), be price-competitive, and once installed, be dependable against the elements for at least 20 years. I quickly discovered it was easy to imagine but not easy to do. Two years and a bunch of money later, we launched our new technology and new company: EternaBond's MicroSealant™ repair tape–"MicroSealant" being the operative word (see *Figure 1*).

It has been ten years now, and well over 100 million linear feet of EternaBond tape have been installed, mostly on aging single-ply roofs systems. Based on the responses from roofing professionals using EternaBond, the company is achieving its performance goals.

EternaBond tape uses a "pressure-sensitive adhesive" (PSA) like most repair tapes on the market, but it is unique in that it is a MicroSealant™, which is a sealant that contains no double bonds between carbon atoms, a completely different morphology than the other PSAs available in the market. But it is still a PSA. What exactly is a pressure-sensitive adhesive? What are pressure-sensitive repair tapes typically made of? Why do some work better than others? That is what this article is about.

There are a large number of repair tapes available that feature a pressure-sensitive adhesive, and new ones are coming out every season. Despite the number, there are only a few variations in the PSA offerings. There are butyls, modified butyls, rubberized asphaltics, and rubberized bitumens. Some manufacturers call these PSAs "hybrids," although that is actually a marketing gimmick. MicroSealant™, however, is morphologically different. This list compromises the most popular PSAs in the science of roofing. The simpler formulations are relatively inexpensive, but they are limited by the types of roofs on which they can be safely or effectively used. They also have narrow application temperature ranges and brief shelf and in-use lives (see *Figure 2*).

The more expensive cross-linked butyl tapes, such as the ones supplied by roofing manufacturers as part of their systems, are excellent for installing membrane systems if the procedures are followed. However, they are less attractive for roof repairs because the strength that the cross-linking adds also inhibits their ability to move. Movement includes wet-in, which is desirable in a repair/restoration tape (*Figure 3*). "Wet-in" is a term that describes what a drop of water does when it comes in contact with dry concrete: it "wets in" to the concrete. It can also be used to describe how aggressively a sealant attaches to the surface. Whether the surface is a roof type or a roof accessory, such as skylights, flashings, copings, ductwork, or gutters, the objective of the PSA is to seal or join various substrates, creating a quick, long-lasting repair.

Figure 3 — Wet-in.

In the best versions, the PSA is capable of wetting into the surface to which it is applied and forming a seal capable of transferring or absorbing stress, with the focus usually being on one or the other. Cross-linked tapes used for installations transfer stress. Repair tapes like MicroSealant™ absorb stress. All do a little of both, some better than others. PSAs must be sticky, of course, and that is where the tackifiers come in. Tackifiers modify the quick-grab and viscoelastic properties of the sealant/adhesive. Tackifiers must have a moderate molecular weight that imparts some cohesive strength and prevents the formation of weak boundary layers at the surface, a phenomenon that happens often with low-quality plasticizers. At the same time, the tackifiers should have a relatively low surface tension so as to readily wet-in to the surface. This is a tricky combination to consistently maintain when scaling up chemically complicated sealants in large quantities, and it is the most common reason roof tapes fail so frequently.

Figure 4

Figure 6 — Substrate failure

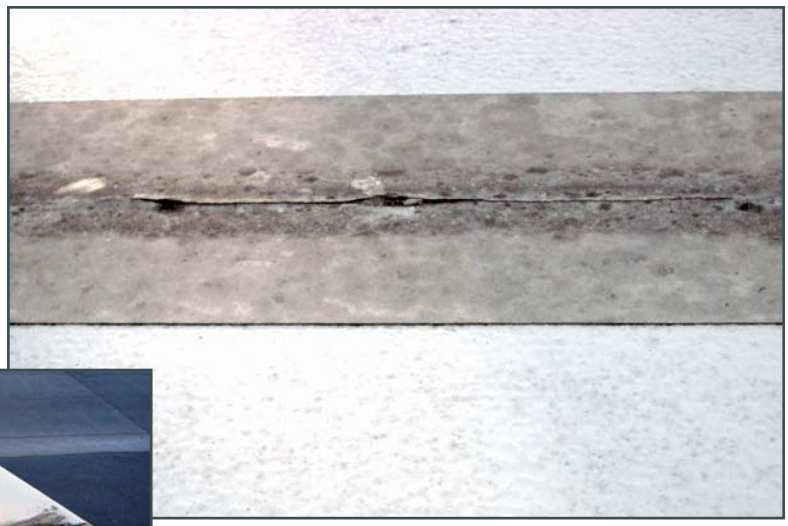

Figure 5 — Adhesive failure

To offset this delicate balance, many PSA tape manufacturers enhance the adhesive properties of the PSA, incorporating modifiers such as tackifier extenders and plasticizers. Tackifier extenders are substances that may be used in conjunction with conventional tackifiers to achieve the same degree of tack at a lower concentration of the tackifier. Plasticizers are substances that improve the physical characteristics of an adhesive by making it softer and more ductile and perhaps easier to handle and apply, often at the expense of wet-in, resulting in a PSA tape that is sticky but has poor wet-in and longevity characteristics. Therefore, base polymer quality, tackifying resins, antioxidants, UV stabilizers, and plasticizers all determine how expensive it is to manufacture and sell a PSA tape.

The three basic types of PSA failures are adhesive, cohesive, and substrate.

Adhesive failure is the most common reason PSA tapes fail. It is what happens when the adhesive fails to adhere along the bond line of the surface to which it is attached, causing it to break away. This is what happens when tapes and sealants eventually lose their grip and peel away or curl at the corners. It is particularly common when the PSA tape is installed on the more complicated single-ply membranes such as TPO, EPDM, and Hypalon. Wet-in never really took place, or the low-quality chemicals used to modify the basic polymer failed or released in a short period of time. In *Figure 5*, adhesive and cohesive failure occurred.

Cohesive failure occurs when the sealant fails to hold together. Cohesive failure can take the form of splits and tears in both transverse and longitudinal directions. Simply put, cohesive failure is when the sealant is stretched beyond its shear point and tears somewhere in the body of the sealant, leaving part of it on each surface. This happens quickly when sealants use too many fillers and/or non-prime chemicals that lose their elasticity at a relatively young age. It can also be the result of the surface that moves beyond the PSA's limits. In summary, the breaking point can be roof movement, PSA shrinkage, or a combination of both.

Substrate failure (*Figure 6*) occurs when the film or fabric that the PSA is attached to fails in the field. Because of the minimal millage of the substrates or backing used on PSA tapes (often as little as 4 mils; rarely more than 10 mils), it doesn't take much variance in the backing formula to have a dramatically negative effect on the film's longevity. The film on a PSA tape needs to be highly UV-stable, dimensionally stable, tear- and puncture-resistant, and flexible. This is a delicate blend to develop. Most films are blown, while some are cast. UV stabilizers quickly reach a point of diminishing return, and in some cases, too much can actually have a negative effect on the UV life of the film. Thin EPDM has no strength, straight TPOs are too inconsistent and difficult to make, and polypropylene and polyethylene quickly become brittle and are dimensionally unstable. Metallics, such as aluminum and coated aluminum, are expensive and tied to the commodities market, and to control costs, they are generally kept very thin—as little as 2 mils—lacking the robustness required for roof applications. Eternabond has found that multilayer TPO rubber blends work best and are the most durable.

There are good tapes available if one is willing to spend a little more money and time finding one that works. For new single-ply roof installations, it's hard to beat the PSA tape the manufacturer has designed for its roof system. They don't wet-in easily, but for lap seams, they are very strong when done right.

For repairs, a high-quality, self-priming, easy, wet-in PSA tape that has a proven record for longevity and compatibility with the different single-ply types is the best answer. These have a chemically complex design, careful manufacturing and quality control, and are typically more expensive but worth it, especially in the long run.

At EternaBond, we like to believe that the development of our MicroSealant™ PSA tape has created a true roof restoration option for the professional roofer. Who would have thought all of this would come from a torn RV roof?

Chris Margarites

Chris Margarites is the founder and president of EternaBond, Inc., a manufacturer of waterproofing tapes featuring microsealant technology. The tapes are widely used in the roofing, HVAC, and RV industries, as well as in manufacturing. Since its inception in 2000, EternaBond has sold over 100 million linear feet of tape and has been repeatedly named by *Inc.* magazine as one of the fastest-growing privately held companies in the U.S. Margarites has been both a repair technician and a contractor and was named "Contractor of the Year" twice in the 1990s by RSES International.