A Fluid Solution: PMMA Roof Membranes

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Introduction

Almost 175 years ago, the low-slope roofing industry began with the construction of roof membranes using a field-applied liquid component and a reinforcing fabric. Built-up roofs using coal tar or bitumen were the standard for well over a century; however, in the last 50 years, factory-produced membranes grew in popularity and also secured a place as a dominant method of roofing application. During recent years, fluid-applied materials, albeit without the use of a kettle, have been filling a need for difficult applications where prefabricated membranes are not the easiest solution.

Fluid-applied materials used as flashing solutions have led to the resurgence of the concept. Fluid-applied membranes improved the continuity from the roofing membrane to the vertical termination. The development of high performance materials to be used at these critical junctions is a major advancement for roofing manufacturers and applicators alike. Based on the reliable performance of the flashing materials, professionals are now beginning to use them for complete roof systems.

Modern fluid-applied membranes are one of the fastest growing sectors of the roofing market.

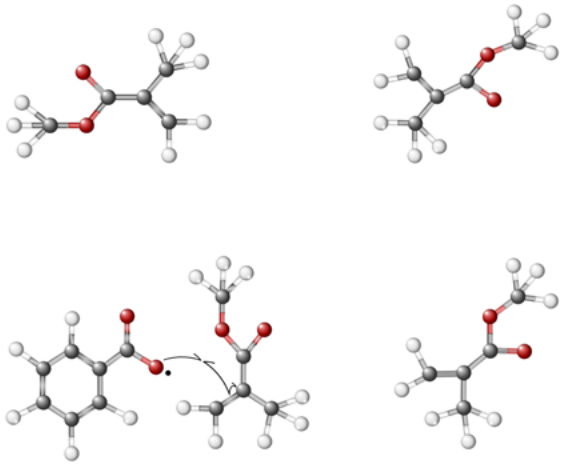
Although they maintain the field-constructed concept of the past, that is where the similarities end. The liquid and reinforcement components that are utilized today are highly engineered. Whether it is the base polymers, the types of curing mechanisms, or the versatility in design, this is not your grandfather's roofing.

History of PMMA

One of the predominate chemistries in Europe and North America is polymethyl methacrylate, commonly referred to as PMMA. PMMA is a widely used polymer known for its toughness and clarity. Applications for PMMA range from bone cement and dental fillings to countertops, road markings, and aquarium glass. The uses for PMMA are quite extensive, but a commonality lies in the intended exposure to harsh in-service conditions. The ability to handle abrasion and its inherent resistance to degradation from ultraviolet (UV) radiation makes PMMA a solid choice for rugged applications such as roofing and waterproofing.
The use of PMMA in roofing and waterproofing has a surprisingly long history. Even though it is often categorized as new technology, it has been used in roofing for over 30 years in Europe and 15 years in the United States.

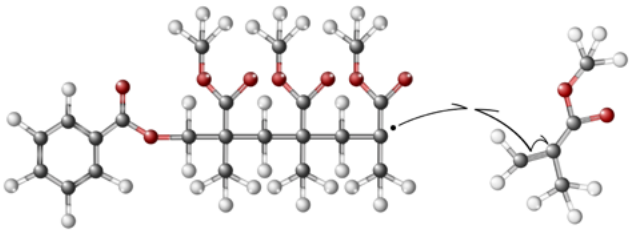
What is PMMA?

PMMA resins, in liquid form, are an intermediate step toward achieving a PMMA roof membrane. Although the liquid contains some PMMA, it is mostly comprised of methyl methacrylate (MMA) monomer blended with a complicated concoction of additives aimed at achieving a particular set of performance characteristics. PMMA resin requires a peroxide to initiate a reaction, which turns the MMA monomers into a high performance PMMA membrane.



Shown above the peroxide catalyst attacks the carbon double bond to initiate the formation of the polymer chain.

The process of curing PMMA is called free radical polymerization. A peroxide is used to react with the MMA monomer and create an unpaired electron. The monomers then begin to link together like a chain. Pure MMA would be too hard and brittle for roofing and waterproofing applications, so additives included in the formulation serve the purpose of increasing flexibility. The key to formulating flexible PMMA is to use additives that participate in the reaction and do not migrate from the cured film.



Shown above polymerization continues as the monomers react with the free radical on the end of the chain. The image represents polymerization in the simplest form and does not include additional components that may participate in the reaction.

Application of PMMA

The PMMA polymer chain has a unique feature that makes it ideal for fluid-applied field applications. The end of the polymer chain is always available for additional links. So, when catalyzed liquid is applied over a cured

Fully reinforced, seamless PMMA flashing applications effectively address both standard and challenging details.

PMMA roof membrane systems are fully reinforced, layered applications consisting of one coat of primer (if required) and a waterproofing membrane comprised of two resin waterproofing coats and polyester fleece fabric.

membrane, such as a lap or tie-in, the polymer chain can continue from the cured membrane into the membrane that is forming. The polymer chain creates a chemical bond between layers of material. A chemical bond is much stronger than a simple adhesion bond and adds a level of attachment that is unmatched outside of factory-controlled conditions. This bonding can be formed on day one or at year ten when an additional penetration through the system is needed.

PMMA polymerization reaction can occur at temperatures below freezing. Most manufacturers will allow application down to 23°F (-5°C), which can be a distinct advantage in colder climates. Materials should be kept in conditioned storage to maintain the proper viscosity and aid in the dispersion of the peroxide. Proper dispersion of the initiator is important to the uniform curing of the membrane. Manufacturers recommend that the initiator be stirred into the material for at least two minutes to ensure full dispersion.

The polymerization of PMMA usually takes less than 45 minutes, depending on the temperature, and the membrane is rainproof in 15 minutes. For many roofers, the peace of mind that comes from knowing that the material is fully cured when they go home for the night is valuable.

In addition to roofing, PMMA can be used for balcony and parking deck surfacing and waterproofing. Its ability to withstand the rigors of pedestrian and vehicular traffic is well known in Europe and makes PMMA a premium choice for many business owners. Inherent toughness makes PMMA a viable option for commercial roofing.

Conclusion

The roofing industry deals with long life cycles, which inevitably affect the speed of technology evolution and acceptance. Combine that with the influence of wisdom and some hardlearned lessons, and the

resistance to change is understandable.

PMMA has established itself over the last three decades as a leader in fluid-applied technology. UV resistance, durability, and fast cure make it a great choice for roofing and waterproofing applications. It seems that PMMA is no longer just a new technology that everyone is watching with a wait-and-see attitude, but an exciting advancement in roofing and waterproofing that could be the beginning of a fluid-applied revolution.

More About the Author

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As General Manager, Kirk oversees Sales and Customer Relations and Technical Development. He joined Siplast in 1999 as Associate Scientist and was named Senior Director, Technical Development, in November 2021. During his 23 years with Siplast, Kirk has become a driving force behind Siplast's R&D efforts, helping introduce new products, making substantial improvements to existing ones, and adding to the number of patents Siplast holds. In addition to his responsibilities at Siplast, Kirk is deeply entrenched in the industry, working closely with a number of industry organizations to develop standards and technical papers while also serving as a member of the ARMA Board of Directors and as the Technical Committee chair for SPRI.

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