

The Compelling Value Proposition of Silicone Coatings for Flat Roofs

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Introduction

The use of liquid applied roof coatings has grown significantly over the past two decades, particularly in the repair and restoration segment. The monolithic nature (no seams) of liquid applied coatings provides ease of installation and labor savings. But perhaps the greatest driver of growth historically has been the benefit of energy savings that reflective elastomeric roof coatings provide. The origins of 'cool roof coatings' in the US can be traced to the research and development by Rohm and Haas company in the early 1980s when comparison studies were performed on rudimentary bird houses constructed with pitched rooftops with dark asphalt shingles and white reflective coatings, and then exposed to sunny conditions. Both the outside roof temperatures and the inside temperatures showed dramatic reductions for the birdhouse constructed with a white reflective roof coating.

These initial results led to a detailed systematic study performed by Rohm and Haas in collaboration with the University of Southern Mississippi and the Mississippi Power Company in 1985. Similar buildings were constructed with flat roofs. Two flat roof buildings had identical ceiling insulation, and the same windows and doors. Both flat roofs were waterproofed with a black asphalt coating. The only marked difference was that the second building had a liquid applied reflective white roof coating added on top of the asphalt coated roof. The summer energy consumption (air conditioning) of the building containing the reflective coating was 21.9% lower than the 'control' house with the black asphalt coated roof. These results spawned numerous additional studies by various companies/agencies/municipalities confirming the energy saving benefits of reflective roof coatings.¹

Why Silicone Roof Coatings?

Acrylic polymers have been the primary binder technology used to date in white reflective coatings due, in large part, to the efforts of Rohm and Haas company developing and promoting elastomeric coatings. In fact, the early success of Henry's reflective coatings technology was based on starter formulations provided by Rohm and Haas. As the technology has evolved, so have the demands of consumers. While reflectivity and associated energy savings are key drivers, other market forces have brought an alternative silicone roof technology to the forefront. There are at least 5 compelling value propositions for silicone coatings for flat roofs:

- Waterproofing Performance
- Rain-Readiness
- Reflectivity/Energy Savings
- Long-Lasting and UV resistant
- Environmentally Friendly

Waterproofing Performance

Silicone polymer technology is superior to acrylic technology with respect to waterproofing capabilities and, after all, the most important function of the roof is to prevent the elements from getting in. Implementation of acrylic technology typically involves application of a *waterproofing base coat of an asphalt emulsion* (or a more expensive base coat of an acrylic coating) followed by application of a topcoat of the reflective elastomeric acrylic coating. The ability of elastomeric silicone coatings to outperform acrylic coatings is exemplified in performance testing utilizing ASTM D7281 Standard Test Method. ASTM D7281 is a rigorous test for waterproofing and is the test method utilized by FM for their Approval Standard for rolled roofing membranes such as TPO, EPDM and the like. Henry was the first to test and pass ASTM D7281 using a liquid applied silicone membrane.² Henry liquid applied silicone membranes pass

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this test standard while acrylic membranes require an asphaltic membrane or the like in combination with the acrylic coating in order to pass. In other words, it is possible to achieve both waterproofing performance and reflectivity with a single coating of Henry's elastomeric silicone roof coating. This is especially important in differentiating performance on flat roofs where ponding water is present. Silicone coating technology performs far better than acrylics in these situations.

Rain-Readiness

One practical matter for liquid applied coatings is that the membranes need to cure. For acrylic coatings, the curing method is drying (water evaporation) to allow for film formation. Because water-based acrylic formulations require extended drying times (up to 24 hrs), the threat of rain can often play havoc with contractor schedules. The contractor does not want to risk having the freshly applied roof coating wash away in rain showers within 24 hours. Silicone roof coatings have a different curing mechanism than acrylic coatings. Silicone roof coatings cure by reacting with moisture in the air to create a cross-linked film. Because of this, we refer to our silicone roof coatings as 'Moisture Cure' technology. By reacting with water in the atmosphere, film formation is rapid compared to acrylics. Depending on temperatures and relative humidity, silicone roof coating formulations can be able to withstand rain showers in as little as 15 minutes following application, saving the contractor time and money by maximizing the efficiency of the crew.

Reflectivity/Energy Savings

As mentioned in the introduction, reflective roof coatings can provide significant energy savings via reduced air conditioning demands. Acrylic coatings still lead the performance aspect of reflectivity, but silicone coatings research is closing the gap. Reflectivity performance with time has been monitored and tested by the Cool Roof Ratings Council for many years. The CRRC database now includes silicone roof coatings. Much like the early days of the acrylic work, silicone coatings have a tendency to pick-up dirt over time. Research by companies like Dow, Arkema and BASF have improved the dirt pick-up resistance of acrylic coatings remarkably. We are in the early cycles of similar development for silicone technology. Initial reflectivities for silicone roof coatings are now comparable to acrylics, and the important reflectivity after aging is making progress. We expect that the gap will continue to close with respect to the aged reflectivity performance of silicone versus acrylic technology. Best-in-class silicone roof coatings now offer initial solar reflectance ratings of 0.88+ and 3 yr aged ratings (from CRRC developed rapid ratings testing) of 0.80+.

Long-Lasting and UV Resistant

Silicone coatings are inorganic (no carbon-hydrogen bonds) and, unlike carbon-based acrylics, are known to be long lasting under exposure to the elements. From a material perspective, silicone roof coating manufacturers offer extended lifetime material guarantees relative to their acrylic counterparts. We expect that properly applied silicone roof coatings can outperform acrylics in performance lifetime. But besides the material differences, one must ensure that other features such as adhesion to substrate, tensile and tear strength, and puncture resistance all meet the necessary requirements for the roof. While well-formulated silicone roof coatings typically adhere well to most substrates, coating other materials on top of the silicone can be challenging. Once a silicone coating is applied, it is recommended that 'refresher' coats over the silicone must also be silicone. We certainly recommend consultation with your roofing contractor or material supplier to ensure the system is compatible.

Environmentally Friendly

Most of the silicone roof coating market has moved away from solvent based formulations. Today's most used silicone roof coatings are 'high solids' (no solvent) formulations and thus contain low or ultra-low VOCs (Volatile Organic Compounds). Roofing applications are a great application area for silicone technology. Silicone coatings have little, if any, impact on the carbon footprint and are manufactured from raw materials starting with the most abundant raw material silicon dioxide. For consumers in the southern US, the energy savings from reduced air conditioning needs will more than pay for the materials/labor over the lifetime of the coating. Anyone considering investing in solar energy panels should first consider reflective coatings, and in particular, silicone coatings as the preferred environmentally friendly solution.

Conclusion

Liquid applied roof coatings continue to take market share due to the plethora of advantages highlighted above. Manufacturers continue to innovate in materials technologies to improve the value proposition. Silicone coatings for flat roofs have grown rapidly in the marketplace, and are expected to continue this trajectory as the combination of waterproofing, reflectivity/energy savings, durability and rain-readiness properties resonate with both contractors and consumers.

¹ Hermanns, C.; Poersch-Panke, H.-G.; Rokowski, J., Techline4 for the Construction Industry, Dow Chemical Company

² Tepe, T. Utilizing ASTM D7281 with Liquid Applied Roof Coatings, presented @ 2018 International Roof Coatings Conference



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