Liquid-applied Roof Coating
An affordable alternative to conventional re-roofing

LIQUID-APPLIED coatings for a wide range of traditional paint and coatings applications have experienced tremendous growth over the past 50 years. High performance coatings are available which will withstand the rigors of severe industrial environments and even the temperature extremes of space flight. In fact, liquid-applied coatings are available today for maintaining, restoring, prolonging and even changing the color of aged and deteriorated asphalt built-up (BUR) and shingled roofs.

These coatings are based on a number of different chemistries with which the roofing professional may not be fully conversant. Although names like acrylic and urethane may be familiar terms in more traditional coating applications, a name such at Hypalon may not. Furthermore, initials like PVA may sound even more unlike roofing terminology, but they are finding their way onto the roofs and the industry.

This article discusses the various types of liquid-applied rehabilitative coatings for roofing applications. Each type of coating chemistry is described with practical emphasis on the application and overall performance properties. The relative durability and economic implications of each type are described. Modern roofing technology has undergone the most explosive proliferation of new technologies, alternative systems, advancements, improvements and a plethora of “latest and greatest” in its history.

With these new technologies comes the responsibility of the roofing professional to familiarize him or herself with the current state of art. For roofing jobs on existing buildings, the question faced by the roofing professional still remains the same: Should an expensive new roof be installed or is there a retrofit alternative which will prolong the life of the existing roof? The answer may be a liquid-applied roof coating applied over the existing aged roof.

Why coatings?

Roofing technologies include the traditional BUR, plus newer systems such as various types of single-ply and modified bitumen sheets and spray-applied polyurethane foam (PUF) with protective coating.

Coatings are firmly established as an integral and required part of the urethane foam roofing system. The type of polyurethane used to make the foam is not durable if left uncoated and begins to powder and degrade within weeks of application if left exposed.

Moreover, the polyurethane foam is rather brittle and its skin can be cracked as a result of impact by falling debris, heavy foot traffic or severe hail storms. The coating helps to protect the foam from these potential mishaps.

Some of these liquid-applied coatings have proven their utility over other substrates besides PUF. They can be used to protect, restore and prolong the life of aged existing BUR or other conventional roofing systems. Unlike re-roofing alternatives, they are extremely lightweight and add virtually nothing to the load of the roof on the deck or supporting members.

Roofs may be recoated several times without contributing significantly to the load. Because these coatings can be formulated white, they can be used very effectively to impart reflectively to the roof.

This not only improves the aesthetics of the roof, but also cools the roofing surface, contributing to longer life. An additional benefit is that since the surface of the roof is cooler, the building inside s cooler, thus reducing the demand for air conditioning. The economic advantages of longer roof service life and reduced energy costs for air conditioning are the economic driving force for reflective roof coatings. Of course, coatings can also be color tinted, so when applied to sloped roofs they can enhance the aesthetics of the overall building.

What is a roof coating?

Technically, these coatings are much more than paints. By definition, they are liquid-applied, fully adhered, elastomeric functional membranes which are formed in situ on the existing roof. In the sense of being adherent to the substrate to which they are applied, in this case, the existing roof, they are paint-like. However, the most distinguishing feature that separates them from paints is that they are flexible.

This flexibility, or elasticity, must exist not only at one temperature but must prevail over the temperature range that exists in the climate where the building stands. This necessary to enable the coating to tolerate the movement of the roof as it responds to the stresses caused by temperature changes, settling of the foundation, weight loads caused by ice and snow, and seasonal expansion and contraction of the roofing envelope. These coatings are normally applied at film thicknesses of 20-30 dry mils (.020 inches to .030 inches) using roller, spray or brush. By comparison, paints are applied at 2-3 mils, thus making these roof coatings approximately ten times thicker than traditional paint.

Classes of Coatings

Roof coatings can be classified into three classes: solvent, water-based and 100 percent solids. Solvent systems are those which contain an organic solvent as carrier for the coating. In this case, solvent evaporation causes the coating to form the membrane on the roof. Water-based coatings are those which obviously employ water as this carrier.

The third class, albeit less common, is the solvent-free coating where two liquid components are premixed in a specially designed airless spray unit. This mixing allows a chemical reaction to proceed which can cause some of these two-part coatings to dry almost immediately. Each of these three coating classes has specific advantages and disadvantages related to the type and presence or absence of solvent.

Solvent coatings

Coating which employ organic solvents can be applied over a wide range of temperature including cold or marginal weather conditions. Moreover, they will dry quickly under conditions of high humidity since the rate of solvent evaporation is not related to relative humidity.

These advantages are offset to some degree, however, by the fact that they contain large percentage of usually flammable and sometime highly toxic organic solvents. Additionally, many of these coatings are required to carry Department of Transportation classified “red label” associated with low flash point. This means that the applicator must exercise care and prudent handling procedures when transporting, storing and applying such coatings.

Also, since these systems contain organic solvents which may soften certain asphalt and other conventional roofing materials, they may cause “bleed through” problems or, even worse, permanent damage to the old roofing substrate. Finally, when using these materials, additional solvent is required to clean the application equipment after use.

Water-based coatings

In contrast, water-based coatings eliminate the flammability and potential toxicity hazards associated with the solvent systems since they use water rather than solvent as the carrier. Moreover, the equipment used can be easily cleaned with soap and water instead of requiring the use of additional solvents. And, their potential for “bleed through” is significantly lower because they do not contain solvents.

Since water is an inexpensive solvent relative to organic solvents cost is usually lower than solvent-based coatings. Finally, the water-based coatings possess one additional advantage in the sense that they can be applied over damp, though perhaps not really wet, substrates without significantly affecting their performance. This means that there is no need to wait for a roofing surface to completely dry before coating with a water-based roof coating. The chief

limitation of water-based coatings is that they can be applied over a somewhat narrower range of atmospheric conditions.

First, they should not be applied at temperature too close to freezing because the rate of water evaporation becomes so slow that they may not dry properly.

Normal cut off point for application of these coatings is 50 F° as the lower acceptable limit.

Second, they should not be applied when rain or inclement weather is imminent. Of course, good roofing practice and common sense dictates that no coating operation with solvent- or water based systems should be carried out when significant precipitation is predicted.

Considerable progress in narrowing this application condition gap between solvent-and water-based coatings has been made with a recent introduction to the marketplace of systems with rather interesting “quick set” properties. Coatings of this type can adequately withstand heavy dew, or in fact, even light rain shortly after their application.

100 percent solid coatings

The third, less common class of roof coating is that which is 100 % [percent] solids.

Since these coatings contain no or virtually no solvents, they do not possess the limitations of the water-based or solvent-based coatings. However, they do require special application equipment and are extremely sensitive to changes in application temperature as their ability to form a durable and long-lasting membrane is dependent on proper mixing ratios of the two components and the reaction temperature.

If the ratio or reaction temperature is incorrect, the coating may inadequately cure or gel prematurely, thus preventing the protective membrane from forming properly.

Types of roof coatings

There are four basic types of roof coatings on the market today based on different chemical technologies: Hypalon, urethane, acrylic, and copolymers of polyvinyl acetate. None of these coating types is based on asphalt and should not be confused with restaurants bituminous cut backs or emulsions.

- ***Hypalon Elastomer***

Hypalon coatings are based on a patented (by E.I DuPont de Nemours Co.) material called chlorosulfonated polyethylene and are usually solvent-based. They are relatively expensive and are normally supplied at low solids to maintain their viscosity at a level which will permit spray application.

- ***Urethane***

Urethane coatings can be classified generally into two types, depending upon whether they are aromatic urethanes or aliphatic urethanes. The aromatic urethanes are not as durable and are used as base coats with the top coat being a more durable aliphatic urethane or acrylic.

Aromatic and aliphatic urethanes are usually supplied as solvent solutions and may be either one-component or two-component systems.

The latter systems involve two separate materials which must be mixed prior to application. The advantage of the two-component coatings is that they will cure more rapidly than their one-component counterparts. However, they require considerable skill in obtaining the correct ratio of the two components, and the quantity that is mixed must be used shortly after mixing, before the “pot life”, usually several hours, has expired and the remaining product gels.

The 100 percent solids coatings are similar to the two-component urethane chemistry previously described. However, since they contain no solvents, they are not prone to the problems associated with typical solvent-based coatings. Urethane coatings are usually rather expensive relative to the other classes.

- ***Acrylics***

Acrylic roof coatings represent a large class of a materials used since 1995. They take advantage of the inherent durability of acrylics found in such products as **LaMaCo - Gem Seal {all range grades}** acrylic coating and in acrylic water-based house paints. Building on this durability of the acrylic chemistry, these coatings can be designed to be very elastic and flexible over a wide temperature range, including such cold weather temperatures as – 15 F° and lower.

They can be supplied as either water-based or solvent-based roof products. As mentioned above, acrylic water-based coatings are available which have the capability to "quick set" or develop a film structure shortly after application. This will resist the potentially damaging effects of early dew and even light rain, thus eliminating one of the inherent disadvantages of water-based coating.

Specialized acrylic coatings are available which can be used in demanding applications such as roofs, where ponded water conditions exist. Of course, this does not negate the fact that every attempt should be made to avoid this condition be having adequate drainage. Acrylic roof coatings posses an excellent balance of high performance and durability at relatively modest cost.

- ***Polyvinyl acetate copolymer***

Polyvinyl acetate copolymer-based coatings are also available for use in roofing applications. These are water-based systems which are usually inexpensive compared to the other chemistries already described. They are used where a white reflective surface over an existing roof is desired, but are of inherently poorer durability and are not recommended where long-term movement of the roof required.

Summary

Liquid-applied roof coatings have proven themselves as useful tools for the roofing professional to restore and protect existing roof. They can be extremely durable and can be used as the first line of defense in the roofing envelope, offering further protection to the other component below.

The coating selected by the roofing professional should be a result of a detailed assessment of the type and condition of the roof, the desired benefit, the capabilities and prescribed uses for the coating, and economic consideration of the individual job. Liquid-applied roof coatings provide a means of prolonging the life of an existing roof, and are often an effective alternative to expensive reproofing.

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An Alternative to a New Roof

Modern roofing technology has undergone the most explosive proliferation of new technologies, alternative systems, advancements, improvements, and a plethora of "latest and greatest" in its history. With these new technologies comes the responsibility of the roofing professional to familiarize him or herself with the current state-of-the-art.

For roofing jobs on existing buildings, the question faced by the roofing professional still remains the same: should an expensive new roof be installed or is there a retrofit alternative which will prolong the life of the existing roof? The answer may be a liquid-applied roof coating over the existing aged roof.

Roofing technologies include the traditional built-up roof (BUR), plus newer systems, such as various types of single ply and modified bitumen sheets and spray-applied polyurethane foam with a protective coating.

Coatings are firmly established as an integral and required part of the urethane foam roofing system. The type of polyurethane used to make the foam is not durable if left uncoated and will begin to powder and degrade within weeks of application. Moreover, polyurethane foam is rather brittle and its skin can be cracked from impact with falling debris, heavy foot traffic, or severe hail storms. Coatings protect the foam these potential mishaps.

Some liquid-applied coatings have also proven their utility over other substrates, and can be used to protect, restore, and prolong the life of aged existing built-up or other conventional roofing systems. Unlike re-roofing alternatives, they are extremely lightweight, adding virtually nothing to the load on the roof deck or supporting members. In fact, roofs may be re-coated several times without contributing significantly to the load.

Because these coatings can be formulated white, they can be effectively used to impart reflectively to the roof. This not only improves aesthetics, but also cools the roofing surface, contributing to longer service life. Since the surface of the roof is cooler, an additional benefit is a reduction in a demand for air conditioning.

The economic advantages of longer roof service life and reduced energy costs for air conditioning are the economic driving forces for reflective roof coatings. However, if aesthetics is a key objective, coatings can also color tinted.

The Difference about Coatings

Technically, these coatings are much more than paints. By definition, they are liquid-applied, fully-adhered, elastomeric functional membranes formed in-situ on the existing roof. In the sense of being adherent to the substrate to which they are applied-in this case, the existing roof-they are paint-like. However, their elastomeric feature, which distinguishes them from paints, means they are also flexible.

This flexibility, or elasticity, must exist not only at one temperature but over the temperature range existing in any particular building's climate. Elasticity enables the coating to tolerate a roof's movement as it responds to the stresses caused and seasonal expansion and contraction of the roofing envelope.

These coatings are normally applied at film thicknesses of 20-30 dry mils (.020 inches to .030 inches) using roller, spray or brush. By comparison, paints are applied at two to three mils, thus making these roof coatings approximately ten times thicker than traditional paints.

Classes of Coatings

Roof coatings can be classified into three classes: solvent, water-based and 100 percent solids. Solvent systems are those which containing an organic solvent as carrier for the coating. In this case, solvent evaporation causes the coating to form the membrane on the roof. Water-based coatings are those coatings employ water as this carrier. The third class, albeit less common, is the solvent-free coating where two liquid components are premixed in a specially designed airless spray unit; a chemical reaction causes some of these two-part coatings to dry almost immediately. Each of these three coating classes has specific advantages and disadvantages related to the type and presence or absence of solvent.

Solvent Coatings

Coating which employ organic solvents can be applied over a wide range of temperature including cold or marginal weather conditions. Moreover, they will dry quickly under conditions of high humidity since the rate of solvent evaporation is not related to relative humidity. These advantages are offset to some degree, however, because they contain large percentages of usually flammable and sometimes highly toxic organic solvents.

Additionally, many of these coatings are required to carry Department of Transportation classified “red label” associated with low flash point. This means that the applicator must exercise care and prudent handling procedures when transporting, storing and applying such coatings. Also, since these systems contain organic solvents which may soften certain asphalt and other conventional roofing materials, they may cause “bleed through” problems or, even worse, permanent damage to the old roofing substrate.

Finally, when using these materials, additional solvent is required to clean the application equipment after use.

Water-based Coatings

In contrast, water-based coatings eliminate the flammability and potential toxicity hazards associated with the solvent systems since they use water-rather than solvent-as the carrier. Additionally, the equipment used can be easily cleaned with soap and water, and their potential for “bleed through” is significantly lower because they do not contain solvents. Since water is an inexpensive solvent cost is usually lower than solvent-based coatings.

Finally, the water-based coatings possess one additional advantage: they can be applied over *damp* substrates without significantly affecting their performance. There is no need to wait for a roofing surface to completely dry before applying a water-based roof coating, although a *wet* surface is not recommended.

The chief limitation of water-based coatings is the narrower range of atmospheric conditions conductive application. First, they should not be applied at temperature too close to freezing because the rate of water evaporation becomes so slow they may not dry properly. Normal cut-off point for application of these coatings is 50 degrees F. Second, they should not be applied when rain or inclement weather is imminent.

Considerable progress in narrowing this application condition gap between solvent-and water-based coatings has been made with a recent introduction to the marketplace of systems with “quick set” properties. Coatings of this type can adequately withstand heavy dew, or light rain shortly after application.

100 Percent Solid Coatings

The third, less common class of roof coating is consists of 100 percent solids. Since these coatings contain virtually no solvents, they do not possess the limitations of the water-based or solvent-based coatings. However, they do require special application equipment and are extremely sensitive to changes in application temperature as their ability to form a durable and long-lasting membrane is dependent on proper mixing ratios of the two components and the reaction temperature. If incorrect, the coating may inadequately cure or may, possibly, gel prematurely, thus preventing the protective membrane from forming properly.

Four Basic Types

There are four basic types of roof coatings on the market today based on different chemicals technologies: Hypalon® elastomer, urethane, acrylic, and copolymers of polyvinyl acetate. None of these coating types is based on asphalt and should not be confused with restaurants or bituminous cut backs or emulsions.

Hypalon Coatings are based on a material called chlorosulfonated polyethylene, and this type of coating is usually solvent-based. These coatings are normally supplied at low solids to maintain their viscosity at a level permitting application with a spray gun.

Urethane coatings can be generally classified into two types: aromatic or aliphatic. Aromatic urethanes are not very durable and are used as base coats with the top coat being a more durable aliphatic urethane or acrylic.

Aromatic and Aliphatic Urethanes are usually supplied as solvent solutions and may be either one- or two- component systems. The latter systems involve two separate materials which must be mixed in a pot prior to application. The advantage of two-component coatings is their ability to cure more rapidly than their one-component counterparts. However, they require considerable skill in obtaining the correct ratio of the two components, and the quantity mixed must be used quickly before the pot life-usually several hours-has expired and the remaining product gels.

The 100 percent solids are similar to the two-component urethane chemistry previously described. However, since they contain no solvents, they are not prone to the problems associated with typical solvent-based coatings. Urethane coatings are usually rather expensive relative to the other classes.

Acrylic Roof Coatings take advantage of the inherent durability of acrylics, and can be designed to be very elastic and flexible over a wide temperature range for a relatively modest cost. In addition, they are supplied as either water- or solvent-based products, although specialized acrylic coatings are available for roofs experiencing ponded water conditions.

Polyvinyl Acetate copolymer-based coatings are also available for roofing applications. These water-based systems, usually inexpensive when compared to the other chemistries, are used where a white reflective surface over an existing roof desired. However, because of shorter durability, they are not recommended where long-term tolerance for roof movement is required.

Liquid-applied roof coatings have proven themselves as useful tools for the roofing professional to restore and protect existing roofs. They can be extremely durable and used as the first-line of defense in the roofing envelope, offering further protection to other components below.

The coating selected should be a result of a detailed assessment of the type and condition of the roof, the desired benefit, the capabilities and prescribed uses for the coating, and the economic considerations, of the individual job. Liquid-applied roof coatings provide a means of prolonging life of an existing roof, and are often an effective alternative to reproofing.

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Selecting Quality Elastomeric Roof Coatings

It seems that each day a new elastomeric (non-asphaltic) roof coating emerges onto the marketplace. Bold claims are made about durability, flexibility, and "ponded water resistance". The specified, consultant, architect, contractor and building owner is now faced with difficult and complex problem of selecting the best coating for the price. How can the decision maker select the correct roof coating?

All roof coatings are not created equal. Manufacturers try to distinguish themselves from their competitors through various techniques, most notably from the Product Data Sheet. However, after 16 years of testing all kind of roof coatings I have difficulty comparing one data sheet to another. Subtle differences in test methods, ambiguity in reported data, and confusion about the meaning of "typical" properties confuses rather than classifies the decision process. The way to make the right choice may start with the Product Data Sheet and quickly proceeds to asking specific questions about the coating.

The Right Coating for the Right Roof

Proper coating selection begins with understanding the expectations of the coating in service and this is often site specific. Will the coating be used purely for aesthetic purpose or will it be required to provide some functional properties? How mechanically sound is the roof substrates for coating? How much standing water is on the roof?

Volume Solids

Coatings are usually priced as cost per wet gallon. However, they are applied to a specific dry film thickness. The important parameter to understand here is Volume Solids. Do not confuse this with weight solids. This is a measure of the volume percent dry coating contained in a gallon of wet coating. Simply put, a roof coating at 50% volume solids selling for $20 a gallon provides the same dry film thickness and coverage as a 25% volume solids coatings selling at $10 per gallon. Thus, the cost differential per gallon does not alter the material cost for the job. However, a higher volume solids coating may save in labor costs if the same mil thickness is achieved with fewer gallons.

Durability

Let's define durability as how well the coating resists weathering, especially sunlight. ASTM methods such as G-26 are used to artificially accelerate weathering. This is a method rather than a specification, which means it describes how to conduct a test but does not list minimum values or standards. Reported values are typically after X thousand hours cracking. The real test of durability is what is the history of that particular coating over the substrate and location for the pending job?

More in-depth questions are, "What is the history of the raw materials?", and specifically the polymer used in the coating. Newer is not necessarily better! The polymer is required to provide the adhesive (stick to the substrate and hold the pigments together) and cohesive (provide elongation and tensile strength) properties. It should have been thoroughly tested, based on years of actual exterior durability.

Pigments are divided into two classes; true (high hiding power ones such as titanium dioxide) pigments and extender pigments, such as calcium carbonate. Just because a coating is opaque to light (you can't see through it) doesn't mean it is opaque to UV radiation from sun. The true pigments are UV opaque and will protect the roof substrate. This is especially important for UV degradable substrates such as-sprayed-in-place urethane foam. UV blocking pigments cost as much as twenty times more than extender pigments. How much UV blocking pigments are used in the coating considered for selection?

Solar reflectance and air conditioner energy savings are becoming more important in selecting white roof coatings. Consequently, dirt pick-up resistance is important in selecting a roof coating. The coating may be white when applied, but how white does it remain after long term exposure in a severe industrial environment? Asphalt bleed through should also be considered when coating over fresh asphaltic or modified bitumen substrates. Again, actual roofs as "proof statements" are important in making an educated decision.

Adhesion

For any coating to function properly, it must adhere. ASTM C-794 or D-903 are quantitative adhesion tests and report numerical values. It is important to ask the film thickness of the coating used in the test and to obtain corresponding data for "wet adhesion". This is vitally important if there areas of standing water on the roof. A coating that exhibits acceptable dry adhesion may delaminate when wet. An obvious, often overlooked variable is the description of the substrate used for adhesion testing. If coating is to be used on a metal roof, adhesion values to polyurethane foam are of little utility.

Mechanical Properties

Elongation and tensile strength properties are often used to promote one elastomeric coating over another. ASTM D-412 is often cited as the test method. Unfortunately, a coating may yield different properties depending on the sample shape and how fast it is pulled in the tester. What about low temperature properties? A coating that may provide satisfactory elongation in downtown Los Angeles may not be suitable cooler climates such as the Rocky Mountains. Moreover, a coating applied to a roofing substrate that is less dynamic, such as precast concrete, may perform satisfactorily, but crack badly over a light gauge metal deck roof system over widely spaced bar joists. Thus, substrate dynamics must be considered when making a prudent choice.

Mechanical properties are usually determined in the laboratory after a short drying and curing cycle. However, in the real world, the coating will still be required to have extension properties and low temperature flexibility at low service temperature after years of exposure. How flexible is the coating at low service temperature after X thousand hours of artificial or accelerated weathering? How flexible is the coating after 5-10 years of actual field weathering on a "real" roof? Plasticizers can be added to a coating to give excellent elongation and flexibility at low temperature. However, these will migrate out of the coating upon weathering and cause the coating to become brittle and possibly fail prematurely.

Conclusion

A prudent roof coating selection requires three input factors. First, the consultant, specified or contractor should have a detailed understanding of the roof to be coated, its substrate, quality and structural dynamics and the expectations of the coating. Second, the Product Data Sheet for the coating should contain meaningful and scientifically accurate values for the product that correspond to some facet of the real world demands on the coating. Finally, after reading this article, the decision maker should also be able to ask incisive questions to fully differentiate and distinguish the candidate coatings considered for the roofing jobs.

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Why Good Weather is Bad for Roofs!
Or
Understanding the Effects of Solar Radiation on Roofs

Consider the plight of the commercial building owner with multiple tenants under an aged and failing roof. On a rainy day, the owner waits in fear for the phone to ring from an irate tenant that"…the roof is leaking!"

"Why wasn't it fixed after the last storm?" And can I deduct the cost of computer repair and productivity down tome from this month's rent?"

On a clear day the building owner can relax knowing at least this day the roof is OK. But is it really? When does the roof deteriorate the most, during inclement weather or clear weather? If one considers precipitation in the form of rain or snow and the resulting flow of water into a building as merely the effect of a roof that has lost its watertight integrity, then the rainy day merely is signifying that the roof leaks.

There's an irony here. Most roofing professionals consider the effect of sunlight, heat and oxygen as what does this say about roof design and longevity? Simply put it means that the roof should be surfaced with a light colored material designed to reflect the sun's infra red radiation. Cooler roofs last longer. Recent studies done by various national laboratories, NASA and state and local municipalities have shown that reflective or "cooler" roofs actually reduce ozone and other atmospheric pollutants. This is because ozone formation is accelerated by heat and atmospheric pollutants are the result of burning fossil fuel to generate electricity to operate air conditioners during hot weather. (*An excellent article written by Dr. Hashem Akbari from Lawrence Berkeley Laboratory called, " Cool Construction Materials Offer Energy Savings and Reduce Smog" published in ASTM Standardization News, November 1995, provides a comprehensive review of this topic*). Moreover these cool roofs also reduce the air conditioning loads on buildings and save electricity in the warm months. In fact, the Georgia Building Code has recently been amended to allow for substitution of "cool roofing materials" such as reflective roof membranes and coatings in place of insulation when designing a roof. The additional cost of using a reflective roof surface can be easily amortized or paid for with reduced electricity consumption during the air conditioning season. This is most effective in lower latitudes and warmer climates.

Let's look at the second source of deterioration coming from the sun. Sunlight contains shorter wavelength ultra violet radiation which has been shown to be the cause of premature aging of our skin and the cause of skin cancers of various types. The UV radiation actually changes the skin cell structure and causes it to mutate and form tumors. On a roof, the process is a bit different. The UV radiation attacks the membrane and causes various chemical reactions to take place. These are observed by the roofing professional during a roof inspection as chalking, splitting, shrinkage, embitterment and other observations we characterize as "weathering". Some roofing materials are more prone to UV attack than others. Asphalt and modified bitumen's contain chemical that can destroyed by UV. This is observed as embitterment, asphalt degradation and cracking. Uncoated sprayed-in-place polyurethane foam can deteriorate and erode as much as a half inch per year as a result of UV attacks on the foam. Some single plies exhibit cracking and severe chalking as the base polymer in the membrane is actually broken into shorter chains by the UV portion of the sunlight. This phenomenon is known as "chain scission".

Now the obvious question is how can the roof be protected from the deleterious effects of the UV radiation? Once again the prudent selection of a UV blocking material on the surface of the waterproofing material can prevent UV attack. Such materials include gravel aggregate, granules, and UV blocking coatings. One word of caution here: because a coating is opaque white do not expect that it will block UV radiation. All non-asphaltic coatings use pigments (tiny rocks that feel like baking flour in their raw material form). These pigments are dispersed in a solvent or water. When the coating dries, the solvent evaporates and the polymer (which may be acrylic, silicone, urethane, butyl or other "binder") adheres the pigments to the substrate, in

this case the roof membrane. Most organic polymers (except aromatics urethanes) do not deteriorate under UV attack but are transparent to UV radiation. This allows the UV to move freely through the coating and attack the substrate, in this case the waterproofing material. The UV can easily be blocked by the incorporation of pigments. This is the same concept as using a sunscreen on your skin at the beach. However, not all pigments will reflect UV radiation, even though the coating appears opaque. Typically a well formulated roof coating may include some titanium dioxide and zinc oxide, two excellent UV blocking pigments. The coating may also contain some calcium carbonate that contributes to visible light opacity, but not to UV blocking. A cheap coating will omit the UV blocking pigments such as titanium dioxide or zinc dioxide. Unfortunately, there is no easy way to identify the presence or amount of UV blocking pigments from merely looking in the can. Coatings that meet ASTM specifications may or may not contain UV blocking pigments. The best source is to ask the coating manufacturer how much UV blocking pigments they incorporate into each gallon of roof coating.

The roof design professional is offered a continually increasing myriad of option from which to select when specifying a roof. Moat all will do a quite satisfactory job of maintaining watertight integrity when the roof is new. The fundamental difference lie's in the selected roof material's ability to resist deterioration from sunlight, both infra red and ultra violet after years of exposure. Where the UV and IR resisting qualities of the roofing membrane are in doubt, the roof design professional can make the appropriate recommendation to include a coating or other surfacing that will reflect the sun's dangerous rays.

The next time a building owner or facility manager mentions to you as a roofing professional that "at least it's not raining", you can reply unfortunately, "the roof is wearing out even faster today!"

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