



valspar

Welcome to Valspar's course on Green Innovations in Architectural Coil Coatings. We're glad you've joined us today.

Let's get started!

Green Innovations in Architectural Coatings



Course Learning Objectives

1. Present the basics of **coating ingredients** and performance.
2. Explain how **green innovations** in coatings create a more sustainable option for metal building products.
3. Discuss how **sustainability goals** can be achieved with green coatings.
4. Identify key **end uses for green coatings**.

Today, we're talking about Green Innovations in Architectural Coatings.

- In the first part of this presentation, I'll present the basics of coatings...what ingredients go into a coating and how they perform.
- Next we'll talk about green innovations in the coatings in the industry and how they create a more sustainable option for metal building products.
- Then, we'll dive a little deeper into the green building trends and how coatings can help achieve sustainability goals from Energy Star to Living Building Challenge.
- We'll wrap up with a brief discussion on key end uses for green coatings.

And I'm happy to take your questions at any time, so please ask!

With that, let's dive in.

Let's get started with the basics of coating ingredients and performance.

Learning Objective One

Present the basics of coating ingredients and performance.



Building With Metal



Economical

Sustainable

Versatile

Beautiful

While our focus today is on coatings used on metal building components, we want to start with the benefits of building with metal.

There are many benefits. Metal is an economical building material. It's also a sustainable building material—able to be recycled and the metal parts in a building are often made from recycled metal. Additionally, the manufacturing process is sustainable.

Metal products provide versatility. They can be used in both new and retrofit projects. And they are beautiful with finish options available.

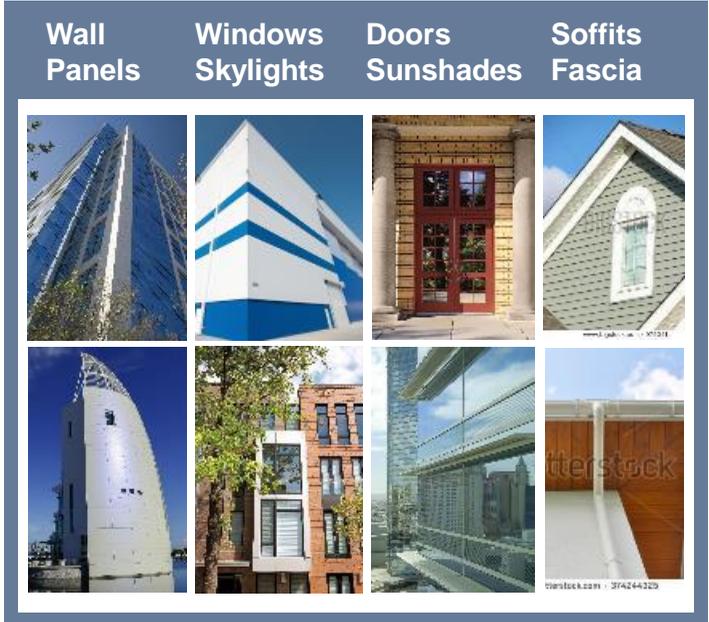


Metal Coatings for Building Products

Coil



Extrusion



There are two basic types of coatings that can be used on metal building products.

The first category is Coil Coatings. These coatings are used on Metal Roofing Systems. They are also used on composite and insulated metal wall panel systems.

Extrusion coatings are used on a number of metal building products including: wall panels, windows and skylights, doors, sunshades, soffits and fascia.



Architectural Coating Types

Coil

- Coating applied to coiled metal
- Fabrication occurs post coating



Extrusion

- Aluminum part is extruded
- Coating applied after fabrication

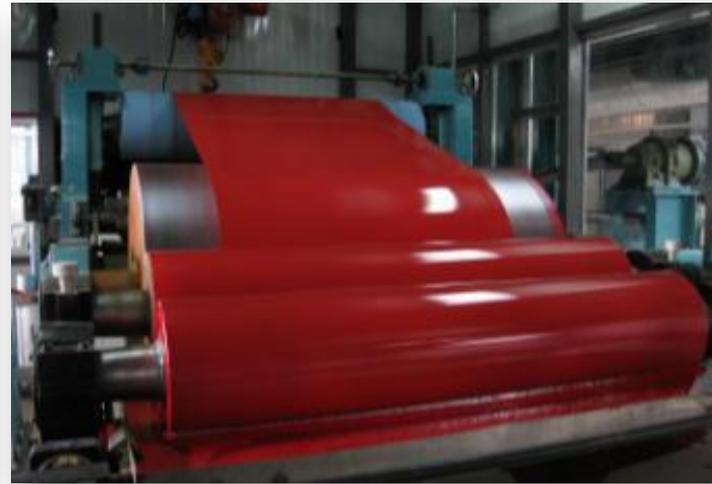


So what exactly is a Coil coating?

Coil coatings are applied on long sheets of coiled metal. That metal is then recoiled and shipped off to the manufacturer to make the end product. So, a coil coating is also known as “pre-painting.” The part is painted before it is made.

In contrast, with Extrusion coatings, the part is made first. Then, the coating is applied.

Coil Coating Process



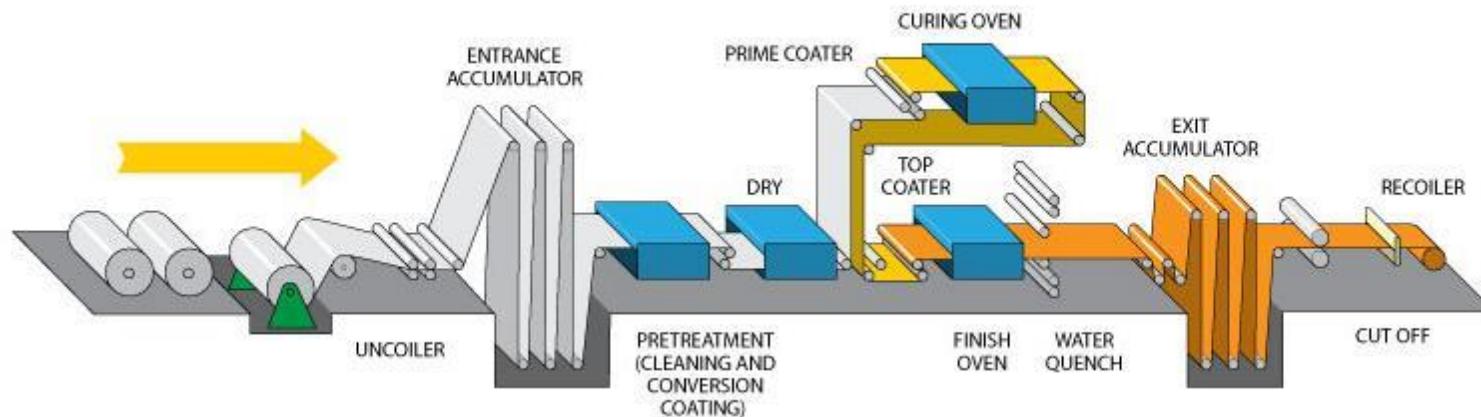
Here's a snapshot of the coil coating process... where the metal is painted BEFORE it's formed into parts.

In the left photo, you see a large roll of the bare metal substrate delivered to the coil coater facility from the metal manufacturer's rolling mill. The coating manufacturer cleans the coil and then applies a coating system.

On the right, you see a photo of the metal coil on a coating machine, where it unrolls in flat sheet form and moves very fast—up to 1,000 feet per minute. Both sides of the metal are coated at the same time with a roller that ensures good flow and uniform paint application.

A range of coatings can be applied. You'll find a wide range of colors, gloss levels and thickness used. The beauty of this type of coating process is how uniform the finish is on the sheet of metal. Once dried, the metal is easily re-coiled and sent out to the component manufacturer to produce the metal parts.

Coil Coating Process

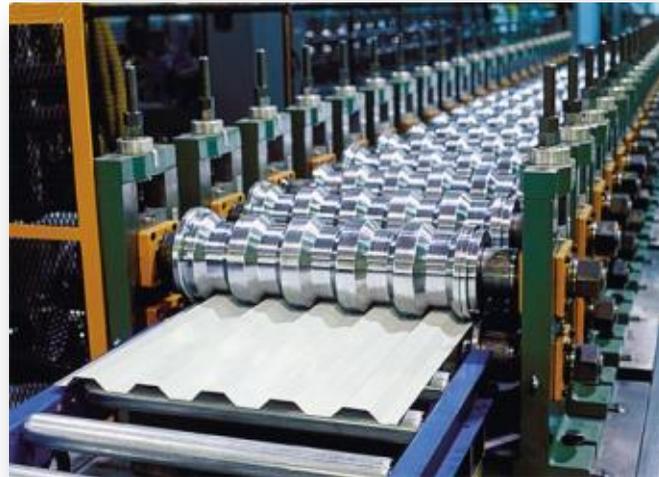


Here is a diagram of the coil coating process.

- At the beginning, you have the uncoiler, which uncoils the metal and feeds it into the entrance accumulator, which helps ensure continuous feed of the sheet metal from roll to roll.
- Next, the metal enters the pretreatment process. The metal is first cleaned and then treated so the primer will stick to the metal.
- The next step is the drying oven, which removes moisture from the metal.
- Next, the metal goes through the prime coater and curing oven.
- This is followed by application of the top coat followed by the curing oven. Then, the coating is quenched with water to stop the curing process.
- In the final step, the coated metal goes through the exit accumulator and is recoiled to be sent to the part manufacturer.

After Coil is Coated...

It can be
cut **slit**
FORMED
profiled corrugated
molded
into variety of shapes for
metal building products
and systems



After the coating is applied, the metal building components are made and they can be cut, corrugated and even molded. The coating is designed so it won't crack or get damaged when the metal is cut and shaped into a building part.

In the photo, you can see an example of a wall panel being produced.

Benefits of Coil Coatings in Manufacturing

- Increases manufacturing efficiency by pre-painting metal
 - Number of steps reduced in product manufacturing process
- Exceeds environmental standards for manufacturing process
 - Paint waste minimized
 - VOCs burned to heat oven, reduce emissions and save energy



There are many benefits of using coil coatings, and manufacturers of metal products really value the efficiency of using pre-painted metal. They don't need a paint operation in their facility, so it reduces a number of steps for them when manufacturing.

And, the coil coating process is very sustainable. Not much paint is wasted. And, the VOCs drying from the paint are burned to heat the drying oven...this not only reduces emissions, it saves energy.

Extrusion Manufacturing

- Forming aluminum into shapes of exact specifications
 - Extrusion presses use high pressure and heat
 - Aluminum can be extruded into wide variety of shapes

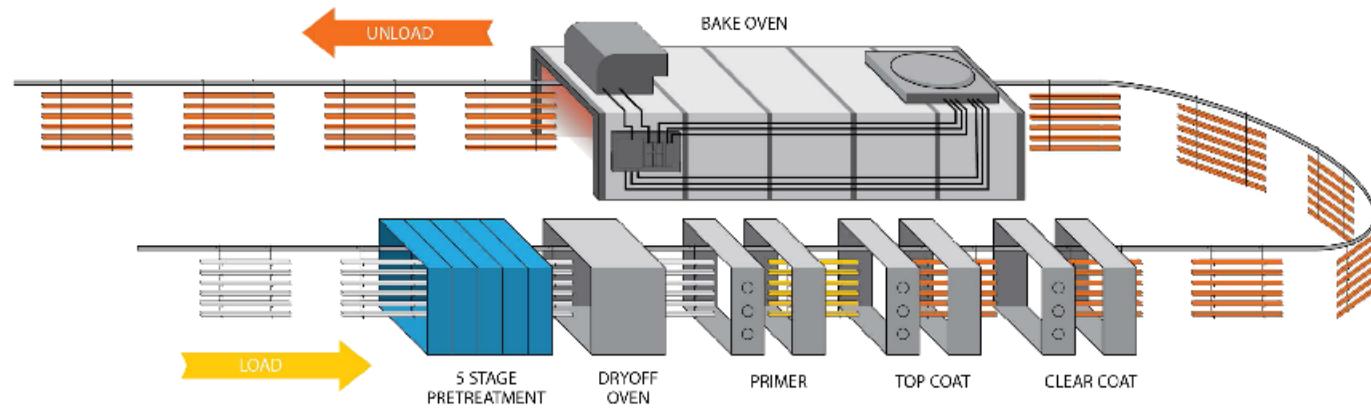


Next, let's take a look at the extrusion manufacturing process.

Manufacturers take a solid block of aluminum, called a billet, and run it through a die to make the shape that is specified for the end product. The extrusion presses use high pressure to force or extrude the aluminum through an opening. Aluminum can be shaped into small or large sizes.

In these photos, you can see some of the products that are made in extrusion manufacturing.

Extrusion Coating Process



Extruded products are painted after they are made.

In this diagram, you see an example of a horizontal manufacturing paint line. It does go at lower to medium production rates so it provides more flexibility in terms of the types of parts that can be coated such as aluminum extrusion curtain walls and aluminum building panels.

- The parts are loaded onto racks.
- Then they go to the 5-stage pre-treatment area to clean and pretreat the part to get solid adhesion during the coating process.
- Then they go through the drying oven to get rid of any moisture left on the part.
- Next, the parts go through a series of spray booths that coat the part on both sides.
- Then, the top coat is applied.
- If the part requires a clear coat, it goes through the clear coat coating station.
- Next, the parts enter a turn-around area, where VOCs are captured and used to fuel the bake oven.
- The parts are then baked for 10 to 12 minutes before they move to the unload area.

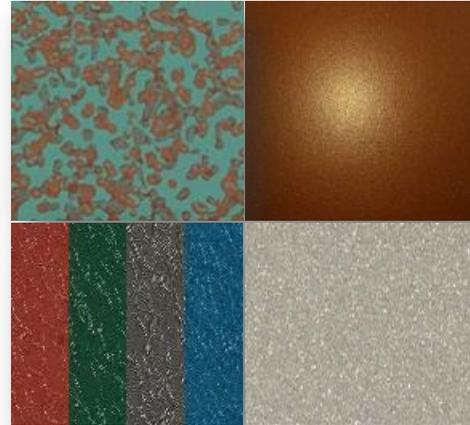


Why Coil and Extrusion Coatings?



Performance

- Protects from dirt, stains, mars, humidity, salt spray, heat, UV rays, chemicals, oxidation, corrosion



Aesthetics

- Outstanding color retention
- Consistent finish
- Variety of finish options and special effects

An important part of a Coil Coating is the great protection it provides.

It protects the metal building components against direct, stains, chemicals and mars. Think about the wear and tear of the front entryway of a store with people going in and out all day long. The coating needs to be tough enough to withstand this use. The environment can also be harsh on a coating. It needs to withstand ultraviolet heat and humidity; and if a building is near the ocean, it is exposed to corrosive salt spray carried in the air. Coatings also help prevent metal from oxidizing.

Coatings also need to be beautiful and coil coatings provide that beauty. Available in thousands of colors, they provide outstanding color retention so the building continues to look great for years. There are many finish options and special effects as you can see in the images on the right, ranging from a textured to a copper look.



Key Coating Ingredients

15%

Pigments

35%

Resin

50%

Solvents

Additives: modifiers



Percentages vary by product type and color.

Next, let's talk about what goes into a coating.

The three main components are: pigments, resins and solvents. There can also be additives used that help the performance and the appearance of paint.

The percentages of each ingredient will vary by the color type specified.



Role of Paint Pigments

- Color
- Opacity to UV light
- Porosity
- Corrosion resistance
- Hardness
- Surface texture
- Gloss level



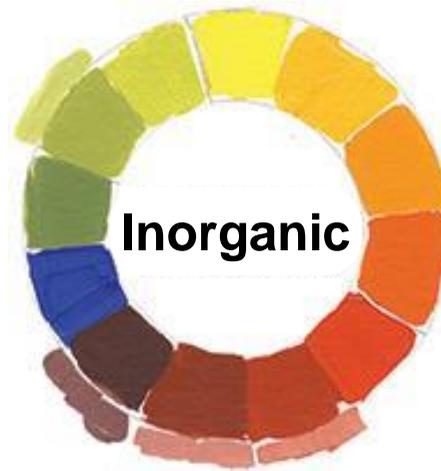
Pigments provide the color in paint, which sounds simple. But the science of color is actually quite sophisticated. Pigments have several jobs in addition to providing color.

Pigments offer additional properties such as total coverage or hide, which is the ability to cover the substrate so you maintain uniform and consistent color. There are also select pigments that offer corrosion resistance. These pigments are especially good to use if you have a project in an aggressive environment where there are industrial chemicals, or there is an ocean-front with airborne salt-spray. The coating system will have the ability to resist corrosion with these corrosive-inhibiting pigments.



Types of Pigments

- Organic
- Inorganic (ceramic)
- Specialty
- Solar Reflective (SR)



There are several different pigment types.

- Organic pigments,
- Inorganic pigments,
- Specialty pigments like pearlescent and color-shifting, and
- Solar Reflective pigments.

In most colors, there is a combination of pigments blended together to create the desired color and performance.



Pigment Performance

- Organic
 - Bright, but low fade resistance
 - Allow UV and water to penetrate
 - Less hiding power; lower weather-resistance
- Inorganic
 - High resistance to fade
 - Most heat stable and chemically inert
 - Excellent UV and weathering resistance
- Several pigments may be blended to create desired color and performance



Pigments offer different performance levels. For example, organic pigments provide the very bright, vivid colors but they aren't as durable.

Inorganic pigments are more stable, don't fade as fast and are very weather resistant.

That's why coatings typically have a blend of pigments to achieve the optimum color and performance.

Role of Resin

- Acts as binder in paint formulation
- Contributes to coating's durability and physical properties
- Increases physical strength and chemical resistance of coating film
- Allows for curing process to occur while paint is drying



Resin is another key ingredient for coatings. It's the glue that holds everything together.

The primary function of resin is to act as the binder in a paint formulation by binding all of the components together. It is the source for a coating's durability and physical properties. It increases the physical strength and chemical resistance of the coating film, and allows for the curing process to occur while paint is drying.



Resin Types and Performance

GOOD	BETTER			BEST
<p>Polyester Generic polymer system with limited weather performance; can achieve wide variety of colors because of the organic pigments used.</p>	<p>Acrylic Provides harder surface and high gloss level not seen with PVDFs.</p>	<p>SMP Blend of polyester and silicone intermediates. Silicone improves gloss retention and weather resistance of polyester coatings.</p>	<p>50% PVDF Provides harder surface, color retention and weather resistance of fluoropolymer coatings.</p>	<p>70% PVDF Current state-of-the-art coating. Carbon/fluorine bond is one of strongest chemical bonds known. Non-sticky finish enables pollutants to wash away.</p>

There are several types of resins used in metal coatings. There are three performance levels for resins – good, better and best.

In the “Good” category, a polyester resin is used...which has more limited weather resistance.

In the “Better” category, there are three options depending on the type of coating. These resins deliver more weather resistance, a harder surface and higher gloss resistance.

At the “Best” end of the spectrum is PVDF. This is the highest-performance resin used for monumental buildings. It is not only strong, it also resists dirt and stains with its non-sticky finish.

Role of Solvents and Performance

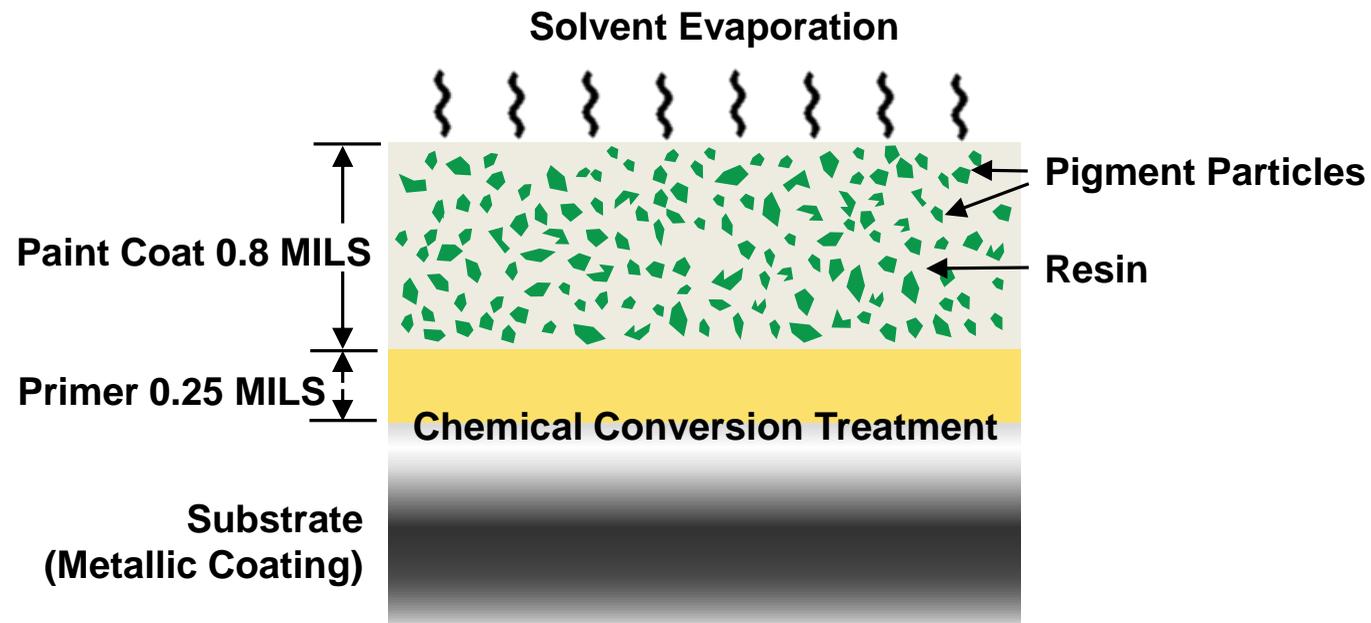
- Used in solvent-borne coatings
 - Blends paint components
 - Controls coating viscosity
 - Evaporates as coating dries and cures
- Solvent type chosen for compatibility with paint system and specific performance requirement needed



Solvents are used in solvent-borne coatings to help blend components, and to control the viscosity or thickness of the coating. These solvents evaporate as the coating dries.

Solvent types are chosen for the performance that's needed. For example, a fast drying solvent can save energy and keeps production rates up on a paint line.

Typical Two-Coat Application



I'd like to describe exactly how a coating gets applied.

In this illustration, you see a typical 2-coat application.

First, the substrate is cleaned and treated chemically to prepare it for the coating.

Then, a primer is applied. The primer binds the top coat to the substrate and provides additional anti-corrosion protection. It's followed by the top coat.

Now, when you add up the thickness of the primer at .25 mils and the paint coat at .8 mils, that is just ONE MIL – or could be compared to the thickness of human hair which ranges between 1 and 3 mils. A plastic bag from the grocery store is .5 mil.

Weathering

- Factors such as:
 - Exposure to sun
 - Moisture and humidity
 - High temperatures
 - Temperature fluctuations
- Lead to:
 - Chalking
 - Color changes
 - Fading



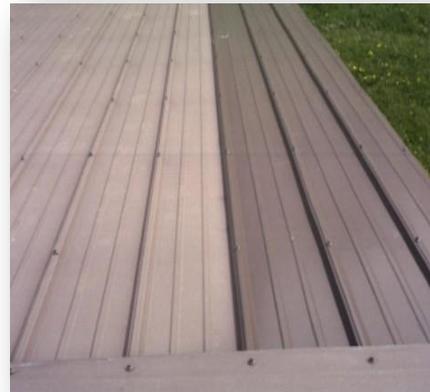
Understanding weather impact on painted metal helps manufacturers develop products to meet specific performance requirements.

Weathering impacts a coating and several factors lead to challenges.

Exposure to the sunlight, moisture, humidity, high temperatures, and temperature fluctuations can lead to color changes in coatings, including chalking and fading. Understanding the weather impact on painted metal helps manufacturers develop coatings that meet a project's performance requirements.

Coatings Over Time...

- Chalking
 - Coating system degrades from UV rays
 - Particles take on white appearance
 - Pigments lose film adhesion
- Color changes and fading
 - Pigment and resin system degrades from UV rays and hydrolysis
 - Color appears lighter or different shade



What exactly do we mean by weathering?

Chalking is exactly what it sounds like. It is when a white chalky film that can be rubbed off develops on the surface of the coating. Chalking is caused by degradation of the resin system at the surface of the finish, due predominantly to exposure to UV rays. As the resin system breaks down, resin particles take on a white appearance, and embedded pigment particles lose their adhesion to the film. The durability and performance of the coating decreases.

Fading is caused by the UV rays of the sun and hydrolytic degradation of the resin system and is measured in Delta E values. The photo shows fading over time.



Physical Testing

- Manufacturers use standard ASTM test methods to measure:
 - Color retention
 - Film thickness and hardness
 - Gloss levels
 - Resistance to solvents
 - Flexibility



The coating industry is continuously testing and evaluating how the weather elements interact with paint.

For example, we know that exposure to UV light usually starts to break down the coating's molecules, but it is a combination of the sun, heat and moisture that can accelerate the damage more than any one factor alone.

Tests and evaluations are performed to appropriate industry association standards by technical experts. There are several standard test methods from ASTM, an international standards organization, that guide scientists in measuring coating performance including:

- Color retention
- Film thickness and hardness
- Gloss levels
- Resistance to solvents
- Flexibility

Rigorous Weather Testing

Two key testing approaches



There are a couple of key types of weather testing that are used. The most important and accurate is natural exposure to the elements. This is done at specialty labs in warm climates like Florida, where panels are exposed to high humidity, heat and salt spray...sometimes for decades. This data is crucial to help scientists continue to innovate and improve the performance of coatings.

The second kind of testing is accelerated indoor testing with machines using salt spray, humidity and heat. This testing is most useful in the development stages of coatings to test various ingredients when formulating to see which ones will be the best choice for a particular coating.



COMPLETED: Learning Objective One

**Present the basics of coating ingredients
and performance.**

With that quick overview, we've completed Learning Objective One.

Now you have a little better understanding of the types of coatings used in metal building components, how they are made and how they work.

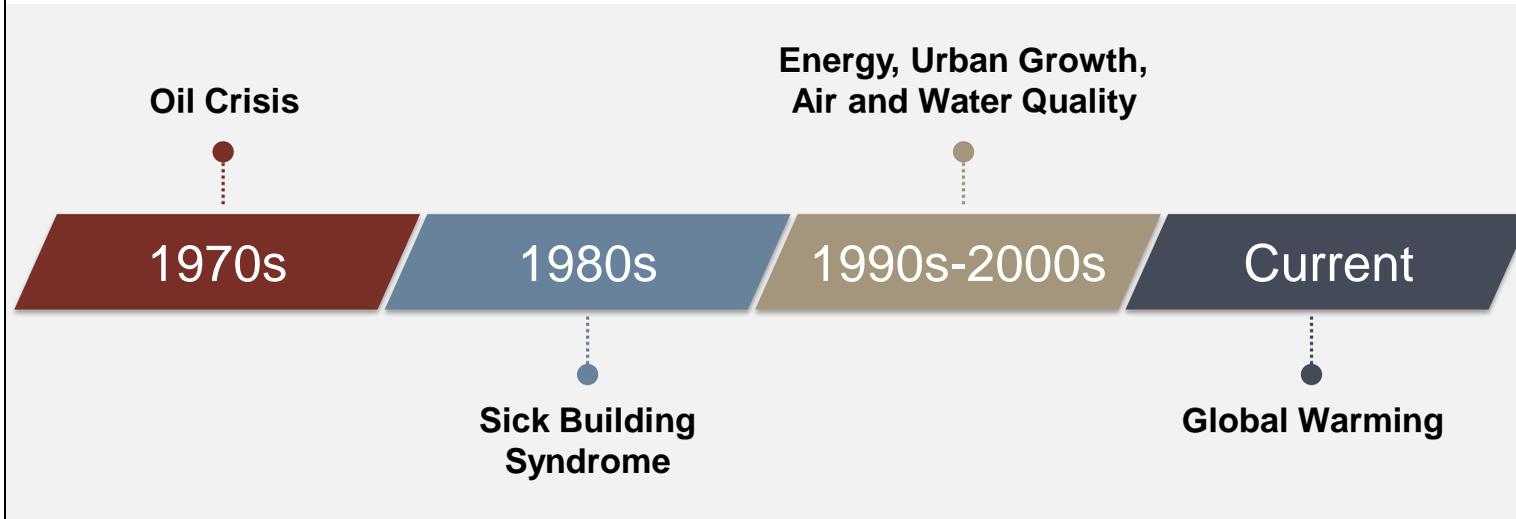
Next, we'll move into talking about green innovations in coatings for the architectural market.

Learning Objective Two

Explain how green innovations in coatings create a more sustainable option for metal building products.

Green Design is Evolving

- Creating high-performance buildings through sustainable design



We've seen a lot change when it comes to green design. Of course, the goal of green design is to be more sustainable yet still be able to create high performance buildings. Often called "sustainable design," this concept has grown and evolved based on a variety of concerns, experiences and needs.

On the far left of this timeline, we had the oil crisis in the 1970s. This led to more global awareness of the need for better energy efficiency in buildings.

In the 1980s, concerns for worker health and productivity became an issue. The term "Sick Building Syndrome" was coined. The potential causes were identified, ranging from lack of fresh-air intake/air filtration to outgassing of building materials, and new building practices began.

In the 1990s through the 2000s, the construction industry made big inroads on water conservation.

All of these factors along with global warming has led to even stronger interest and requirements for sustainability and green design. The thinking has evolved to integrate many factors to create a sustainable "high performance" building.

Energy Costs are Rising



Changing how building owners,
construction professionals and architects select
building materials

Energy costs continue to rise, which is changing the way building materials are selected. Energy continues to be a key driver in design.

Scale of Energy Problem

- Buildings account for up to 40% of primary energy consumption
 - Carbon footprint exceeds all transportation sectors combined
 - Air-conditioning units can account for more than 20% of total consumption in some countries
 - Traditional roof is one of least energy-efficient building components



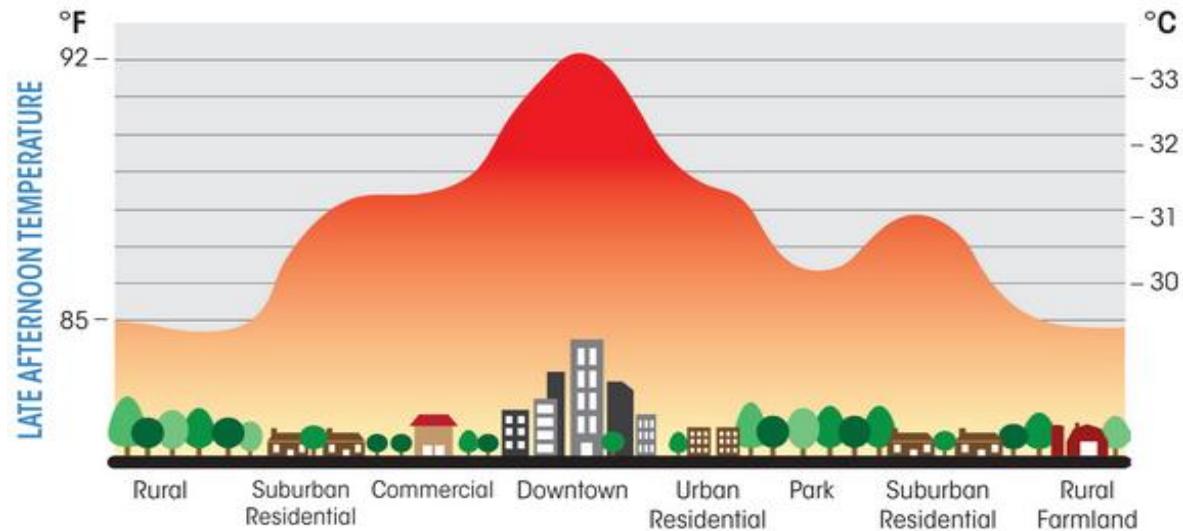
Buildings account for up to 40% of all energy consumed. That's a huge percentage. It's so big that this sector EXCEEDS the energy use in ALL transportation sectors combined. In other words, we spend more to heat and cool buildings than on fuel for cars, trucks, boats, airplanes and every other energy-powered vehicle. Air conditioning alone can account for more than 20% of total energy consumption in some countries.

And, the traditional roof is one of the least energy-efficient building components.

*Source: Potential for a New Generation of Solar-Reflective Coatings, PCI Magazine

Urban Heat Island Effect

- Common to cities in industrialized nations
- Outside air temp is 5 to 10 degrees hotter than outlying areas
- Results in higher energy costs to cool buildings



The term “heat island” is used to describe built-up urban areas that are hotter than their surrounding areas. The urban heat island effect is common to cities in industrialized nations.

This graph illustrates how the spread of homes and buildings has increased and how heat is held in the center of the metropolis...in this case we are looking at Atlanta, Georgia. The downtown area is significantly warmer than its surrounding areas. The farther away from the urban core you move, the cooler it becomes.

In fact, air temperature can be as much as 5 to 10 degrees Fahrenheit warmer in the urban core than in outlying areas. This is because there isn't as much vegetation and soil moisture in a metropolis. Sunlight and heat are easily absorbed by manmade structures such as buildings and roads. This increases both the surface and ambient air temperature, resulting in higher energy costs to cool buildings.

In addition, urban heat islands:

- change regional weather patterns
- increase smog and pollution levels
- compromise air quality
- raise the temperature of waterways, and
- impact health and the environment.

Resource: U.S. Environmental Protection Agency (EPA), State and Local Climate and Energy Program, Heat Island Effect, www.epa.gov/heatisld/index.htm



Heat Island Effect – Roofing



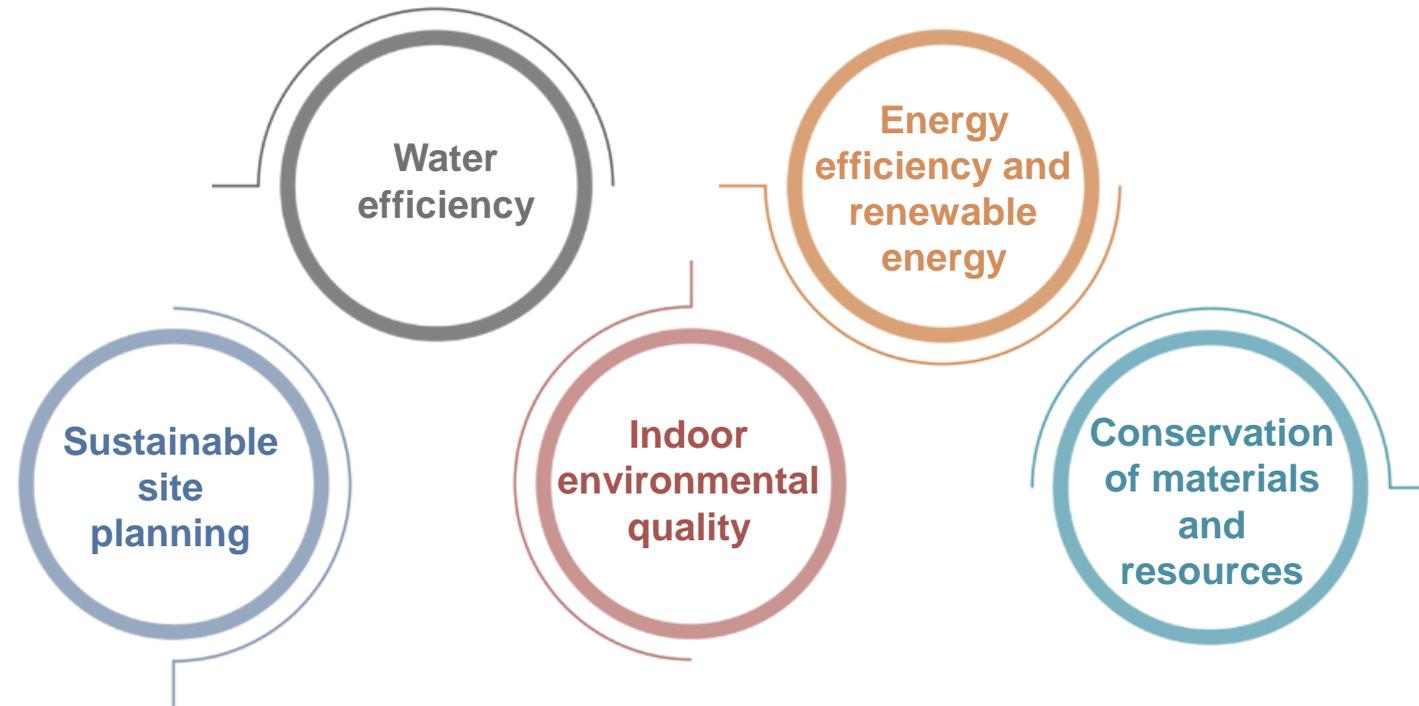
Higher temperatures in urban areas caused,
in part, by dark roof surfaces

Source: leeduser.com

Standard roofs are one of the least energy-efficient parts of a building because they are typically dark and absorb the heat from the sun.

Now, metal coatings are available for metal roofs that reflect the sun's rays. We'll talk more about that in a little bit, but it's a great advancement for the building industry in reducing cooling costs.

Sustainable Design Principles



According to the GSA, a U.S. government organization, the goal of sustainable design is to reduce negative impacts on the environment, and the health and comfort of building occupants to improve building performance.

Sustainable design principles include:

- Sustainable site planning;
- Protecting and conserving water so use is as efficient as possible;
- Enhancing indoor environmental quality;
- Using energy as efficiently as possible and using renewable energy as much as possible
- Using environmentally preferable products and conserving materials where possible and, of course once the building is built, the goal is also to optimize operational and maintenance practices.

This integrated approach positively impacts all phases of a building's life-cycle, including design, construction, operation and decommissioning.

Coatings can help improve energy efficiency, conserve materials and resources, and improve indoor air quality.

Green Coating Innovation

PROTECTING
air & water quality
while **REDUCING** unnecessary
consumption of
natural resources



The principles of sustainable design also apply to coatings. The goal is to reduce negative impacts on the environment...protecting air and water quality and reducing unnecessary consumption of natural resources without compromising the bottom line.

Let's take a little deeper look at how quickly this concept is moving forward in coatings.

Green Coating Development

- Energy efficiency
 - Decreased energy consumption with solar-reflective coatings
- Conservation of materials and resources
 - Increased use of safer, biorenewable and recycled materials
 - Increased product life span
 - Reduced waste and pollution
- Improve indoor air quality
 - Lowered VOCs
 - High solids coatings



Rapid Changes Underway

There have been a lot of innovations achieved in the development of green coatings. It takes a combination of scientists using chemistry and physical science paired with decades of innovative formulation experience to take a whole new approach to formulation.

Within the category of energy efficiency, we are keeping metal roofs and walls cooler and decreasing energy consumption through the use of solar-reflective coatings.

We're conserving materials and resources by using safer, biorenewable and recycled materials. We've also increased how long a coating lasts. And, we're reducing waste and pollution in all aspects of coating design, from how it is formulated and applied to how it is cured.

We're improving air quality through the use of more solids in coatings, which lowers the VOCs released in the air.

Rapid changes are underway to continue the green revolution in coatings.



Types of Green Coatings



Solar-reflective



Chrome-free



High-solids



Biorenewable

Let's talk about four types of coatings that will make a difference in how you specify your coating materials.

There are four main categories: solar-reflective, chrome-free, high-solids and biorenewable coatings.

Let's take a little closer look at each of these coating types.



Green Solar-Reflective Coatings

- Full line of eco-friendly colored coatings designed to reflect solar heat
- Used on metal building components
 - Roofs
 - Wall panels
 - Extrusions
- Energy costs lowered by 10-30%



No Sacrifice to Durability, Performance or Beauty

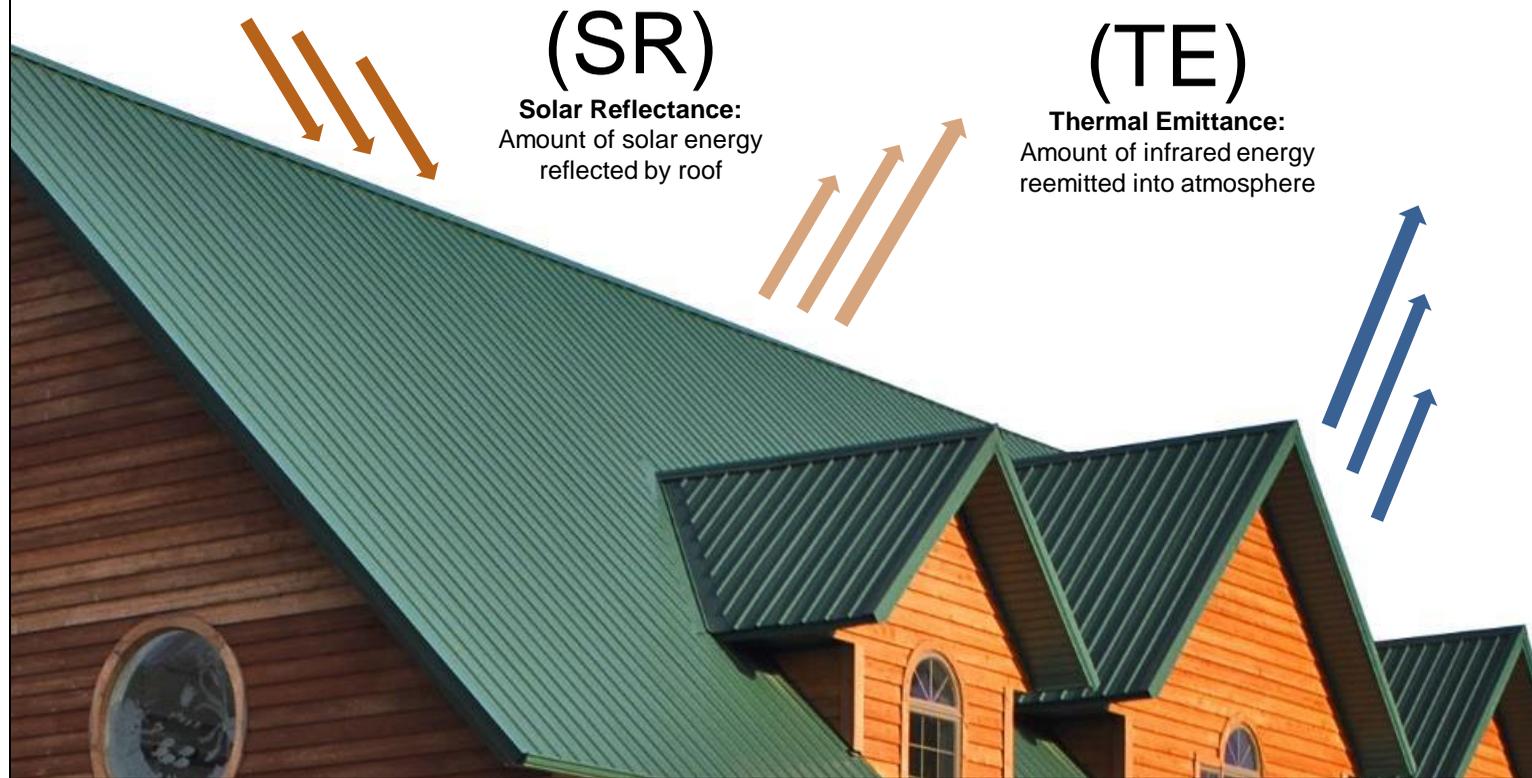
A huge advancement has been seen with the development of solar-reflective coatings. You'll find a full line of these eco-friendly coatings available for use on metal building components including roofs and metal wall panels.

These coatings contain solar-reflective pigments that reflect solar heat back into the atmosphere rather than absorbing them into the building.

Solar reflective coatings reduce energy costs by 10 to 30 percent without sacrificing the durability, the performance or the beauty of the building.



Cool Roof: Energy-Friendly Combination



A cool roof is a metal roof with a solar-reflective coating. It reflects the sun's heat back into the atmosphere, keeping the temperature of the roof lower and reducing the amount of heat transferred into the building. The coolness of the roof is determined by several factors: geographical location, the local climate, materials used in the building envelope, the building's design and what kind of insulation was used.

Two key properties important to the temperature that a roof will reach in direct sunlight are:

- solar reflectance (SR), the amount of solar energy that is immediately reflected from a surface, and
- thermal emittance (TE), the amount of heat energy a surface can re-emit in the form of infrared energy into the atmosphere.

A cool roof with a high solar reflectance and a high thermal emittance will have a lower surface temperature compared to a roof with low solar reflectance and emittance. When the surface temperature of the roof stays cooler, there is less heat gain in the building below. This means the building stays cooler and less energy is needed to cool the building, resulting in lower energy bills.



Cool Coatings Improve Reflectivity



Standard .67
Cool .71



Standard .47
Cool .50



Standard .21
Cool .40



Standard .25
Cool .35



Standard .14
Cool .47



Standard .11
Cool .33



Standard .08
Cool .35

**Nationwide Use Could Deliver More than \$1 Billion
in Annual Energy Savings**

Coatings manufacturers have come up with a coating reflectance number for the various coating colors.

You might be surprised to learn that with the advances in technology, a whole range of solar-reflective roof colors are available. Of course, white is the best at reflecting the heat, but all of these colors qualify for contributing to Energy Star and LEED credits given their excellent performance in reducing energy costs. Estimates show that nationally we could achieve more than \$1 billion a year in energy savings if all buildings had reflective roofs. This shows the significant opportunity that roofs provide in reducing energy costs.



Green Chrome-Free Coatings

- Full coating line
- Replaced hexavalent chromium by:
 - Using different materials
 - Changing production process



Maintain Corrosion Resistance Without Adverse Environmental or Cost Implications

Our next category is chrome-free coatings. This innovation breakthrough took some time...to get rid of the heavy metal hexavalent chromium and replace it with another material. Production processes also had to be changed to ensure the coatings maintained their ability to protect metal against corrosion without an adverse impact to the environment or cost of the product. There are primers, topcoats, clear coats and other types of coatings available that work on certain substrates.

Chrome-Free Evolution

- European Union began regulating use of heavy metals
- Toxic heavy metals essential to coatings industry for decades
- Removing metal from coatings was challenging
- Scientists developed new formulations that didn't sacrifice performance



Toxic heavy metals were essential to the coatings industry for decades. In particular, chromium was used for its superb corrosion-inhibiting properties. When regulations were put into place by the European Union to reduce the use of heavy metals in all kinds of products, the innovation to chrome-free coatings began.

Removing chromium from a coating while maintaining superb corrosion-inhibiting properties is no small task. The implications presented a whole new set of challenges. Scientists had to figure out how to maintain corrosion resistance using eco-friendly materials without adversely affecting the environment or significantly increasing the cost of coatings.

And, they have succeeded. Today, manufacturers offer a range of chrome-free coatings for all kinds of applications, ranging from interior walls to high-performance metal coatings for the architectural industry.



Green High-Solid Coatings

- Solvents reduced by more than 60%
- Higher coverage rate
- Less waste



Better Coverage Means Lower Costs

Our third category of green coatings are high-solids.

A high solid is the ingredient in a coating that is left behind on the product once the coating is applied and the water or solvents used to help spread the coating during the application process dry and evaporate.

High-Solid Coatings Benefits

- **Compatibility**
 - Broad range of metal substrates and insulating foam
- **Versatility**
 - High concentration of pigments; can use one or two coats
- **Low VOCs**
 - Higher solids
 - Broader spread rate
- **Cost-effective**
 - 20% annual savings in total applied cost compared to standard coatings



There are several really nice features of high-solid coatings.

First, they can be used on a broad range of metal substrates. They can even be used on insulating foam.

Second, they are versatile. Because they have a high concentration of pigments, manufacturers can use one or two coats depending on the project's need.

Third, higher solid content means less to evaporate which translates into lower amounts of VOCs being transmitted into the air or captured and burned for fuel. And these coatings have also been designed to spread 50 to 70% better and easier than standard coatings. So there can be double benefits with the high-solid content.

Finally, these coatings actually cost LESS to use...they can deliver up to 20% in annual savings in total applied cost.

Green Biorenewable Coatings

- Use replenishable raw materials
 - Vegetable oils
 - Recycled ingredients



Innovating with Readily-Available Ingredients

The fourth category in green coatings is biorenewable. They reduce waste through the use of naturally replenishable ingredients such as vegetable oil. Recycled ingredients can also be used.

There is less dependence on fossil fuels with biorenewable coatings, which is great for the environment since fossil fuels take millions of years to form while an ingredient like oil can be produced within one growing season.

Biorenewable Coating Benefits

- Up to 30% biorenewable raw materials
- Higher solid content
- Increased square foot coverage
- Low VOCs
- Reduced carbon footprint
- Same applied cost



Now if you are interested in using bio-renewable coatings, ask the coating manufacturer questions about their products so you know what you are buying. Some coatings manufacturers are only using biorenewable materials in their solvents, which evaporate during the curing process. Other manufacturers are using up to 30% biorenewable raw materials in the core components of the coating, like the resin system, resulting in a more sustainable finished product.

Biorenewables have a higher solid-content, spread more easily and increase the amount of square feet that can be coated, and have low VOCs released into the air when drying. All of these factors help reduce the carbon footprint of the coating.

AND, there is an added bonus. Biorenewable coatings have the same applied cost as a standard polyester coating.



COMPLETED: Learning Objective Two

**Explain how green innovations in coatings
create a more sustainable option for metal
building products.**

With that, we've completed our Second Learning Objective. I hope you now have a better understanding of how green innovations in coatings are a more sustainable option.



Learning Objective Three

Discuss how sustainability goals can be achieved with green coatings.

Our Third Learning Objective is to dive into the big broad topic of sustainability goals and talk about how green coatings can help achieve those goals.



Green Building Industry

Key Categories Related to Green Coatings

1

Energy
Efficiency

2

Transparency

3

Hazardous
Materials

In the Green Building Industry, there are three main areas of interest for coatings—how they can help with energy efficiency, transparency about what's in a coating, and the reduction of hazardous materials wherever possible.

Green Building Industry Standards



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\$145 Billion Annual Green Opportunity

Next, let's look at some of the leading standards related to coatings. The more comprehensive Green Building programs include LEED, which is part of the U.S. Green Building Council, and Living Building Challenge.

Product standard organizations in this space include:

- The Cool Roof Rating Council, or CRRC;
- RoHS—Restriction of Hazardous Substances—which is a European organization; and
- Energy Star.

Some coatings manufacturers actively participate in several of these important green initiatives. They don't just comply with regulations, they sit on councils or boards, allowing them to create eco-centric initiatives for the future.

According to the U.S. Green Building Council, it's estimated that this year, 40 to 48 percent of new nonresidential construction will be green. This equates to a \$120-145 billion opportunity. And between 25-33% of retrofit and renovations will be green. This is a \$14 to \$18 billion opportunity.

Energy Star: Efficient Buildings



Products that earn this certification use less energy and prevent greenhouse gas emissions by meeting strict efficiency guidelines.

Thousands of coatings on ENERGY STAR qualified products list



ENERGY STAR was introduced in 1992 by the US Environmental Protection Agency, commonly called the EPA. It's a voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Interestingly enough, computers and monitors were the first-labeled products. Today the ENERGY STAR label is now on major appliances, office equipment, lighting, home electronics, new homes, and commercial and industrial buildings and plants.

The great news is that there are thousands of coatings on the ENERGY STAR qualified products list, most of them fall into the category of solar-reflective coatings.



CRRC: Cooler Roofs



Roof surface products with reflective property values are rated under strict CRRC requirements to reduce cooling costs for buildings.



Wide range of solar-reflective coatings meet strict requirements

“Cool” roofing is the fastest growing sector of the roofing industry, thanks to increasing awareness of the benefits of cool roofs in helping a building or home be more comfortable and energy-efficient. The variety of cool roofing products is also growing.

The Cool Roof Rating Council, known as the CRRC, was formed in 1998. Its goal was to develop accurate and credible methods for evaluating and labeling the radiative properties of roofing products. This non-profit educational organization has strict guidelines governing its rating systems for roof surfaces, making it easier to understand and compare various roofing options using independent, reliable roof performance data.

There is a wide range of solar-reflective coatings rated under the CRRC program, making it much easier for people to select the best color to use on their metal roof based on a combination of aesthetics and performance.

RoHS: Safer Coatings



European Union directive restricting use of hazardous substances in products, making sure alternative solutions are safer for people and the environment.

Coatings formulated and available to meet RoHS standards



The 2003 enactment of the first RoHS regulation by the European Union has spurred the removal of selected heavy metals like lead, cadmium, and hexavalent chromium from products around the globe.

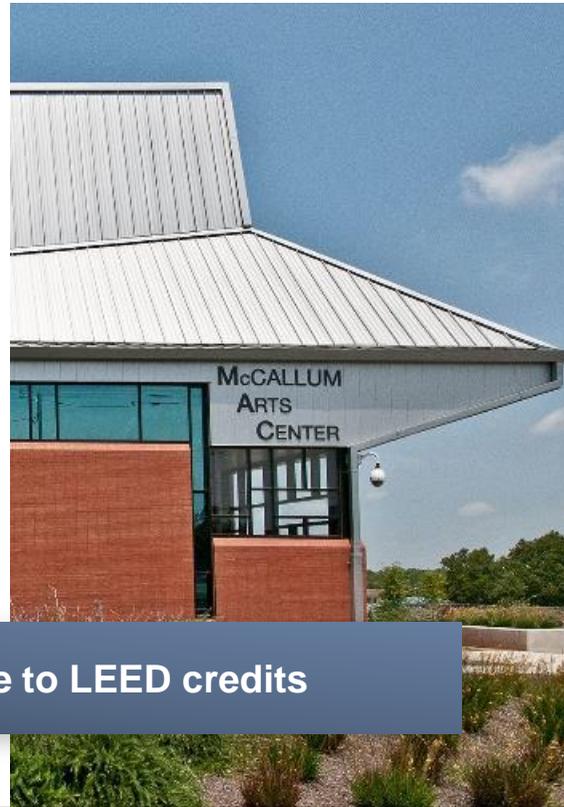
Coating manufacturers responded to ensure they could provide coatings that met the RoHS standard.

LEED®: Green Buildings



Certification program addresses sustainability issues, including resource efficiency, water and energy use, and greenhouse gas emissions.

Green coating systems can contribute to LEED credits



LEED, which stands for Leadership in Energy and Environmental Design, has changed the way we think about how buildings and communities are planned, constructed, maintained and operated. This member-focused association provides minimum safeguards for codes and standards used to construct safe, sustainable, affordable and resilient structures.

Since it began in 1994, LEED has grown to become the most widely used third-party verification for green buildings, with nearly 85,000 buildings and 14 billion square feet being certified. LEED is referenced in 71% of the projects valued at \$50 million and over.

LEED v4 has several new features. One is related to the building materials that are used. It focuses more closely on communicating about the composition of products and the effect those components have on human health and the environment.

Coatings manufacturers are responding by providing greater transparency about the ingredients used in coatings so the new requirements can be met and green coating systems can contribute to LEED credits.

LBC: Green Buildings



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Rigorous building certification program that defines the most advanced measure of sustainability in the industry.

Coating formulations available to meet LBC requirements



The Living Building Challenge, known as LBC, is an international sustainable building certification program created in 2006 by the non-profit International Living Future Institute. It is designed to promote the most advanced measurement of sustainability in the built environment, from infrastructure and landscapes to buildings, neighborhoods and communities.

Certification is based on actual rather than anticipated performance. Projects must be operational for at least 12 consecutive months prior to evaluation. There is a lot of information on the Living Building Challenge website if you are interested in learning more.

There are compliant coating formulations available that meet LBC requirements.

LEED: More In-Depth



Let's take a deeper look into the two broader green building initiatives: LEED and Living Building Challenge and get more specific on their coatings requirements.

First, we'll talk about LEED.

LEED v4 Green Building Credit Categories

- Water Efficiency (WE)
- Location and Transportation (LT)
- Energy and Atmosphere (EA)
- Indoor Environmental Quality (EQ)
- Innovation (IN)
- Regional Priority (RP)
- Sustainable Sites (SS)
- Materials & Resources (MR)



Coatings Help Contribute to LEED Credits under SS and MR

Within the LEED v4 credit categories, coatings fall into two categories:

- Sustainable Sites and
- Materials & Resources. Coatings can help contribute to credits within these two categories.



LEED v4 Coating Credit Categories

Sustainable Sites (SS)

- Heat island reduction – roof

Materials and Resources (MR)

- Building Product Disclosure and Optimization (BPDO) – material ingredients
- BPDO – environmental product declarations
- Building life cycle impact reduction

More specifically, within Sustainable Sites, there are specific guidelines around Heat island reduction using “cool roofs” and we have already discussed the benefits of solar-reflective coatings on metal roofs that will reduce the heat island effect in urban areas.

Under the Materials and Resources category, there are three areas where coil and extrusion coatings can contribute to credits. Two of those areas relate to disclosure of materials used in building product. The third relates to reducing the impact of the materials you use not just when you’re building but throughout the building’s life cycle.

Other coatings like interior paints can contribute in other categories, such as indoor air credits, but today our focus is on coil and extrusion coatings.

LEED v4 Increased SRI Standards

- Solar-reflective coatings
 - Increased SR and SRI values
 - SRI combination of initial SR and TE values

ROOF TYPE	SLOPE	ICC SR / SRI	ENERGY STAR SR	LEED 2009 SRI	LEED v4 SRI	LEED v4 3 yr SRI
Low-Slope	≤ 2:12	≤ 0.70	≤ 0.65	78	82	64
Steep-Slope	≥ 2:12	82	≤ 0.25	29	39	32

Significant Impact on Coating Industry

LEED v4 has introduced significantly higher guidelines for the performance of Solar-reflective coatings. The chart you see gets a bit technical. It shows performance standards from several organizations...and LEED v4 is the highest.

In the two columns on the right of the chart, the numbers are highlighted in red. LEED has both performance standards for the coating when it is first applied and installed, and then the performance that it needs to maintain after three years on the project to ensure the coating will continue to perform well over time as weathering occurs.

LEED v4 Documentation for Coatings

- STEP 1** | Request ingredient list document
- Declare
 - Environmental Product Declaration (EPD)
- STEP 2** | Complete your LEED documentation forms
- STEP 3** | Submit to LEED

Partner With Your Coatings Manufacturer



We want to break down the steps in fairly simple terms here for what is required for documenting coatings as part of LEED's Building Product Disclosure and Optimization credits.

The first step is getting a document that contains the ingredient list. It could be a Declare form through Living Building Challenge, which is a form with information about your company and products, or it could be an Environmental Product Declaration, called an EPD. These are just a couple of examples of the forms that could be used.

From there, you move to Step 2, which is completing your LEED document forms and then Step 3, submitting those forms.

Sample Documentation

Declare.

Product Name
Manufacturer Name
Final Assembly: City, State, Country
Life Expectancy: 000 YEARS
End of Life Options: Recyclable (42%), Landfill

Ingredients:
Ingredient One (Location, ST), **The Second Item** (Location, ST), **Next Ingredient** (Location, ST), **Living Building Challenge Red List***, **Different Part of the Product. Another Component. More Stuff. US EPA Chemical of Concern. Yet Another Item. Non-toxic Element. Piece of the whole. Component of Concoction. Third From The End. ECHA REACH Substance of Very High Concern. Last Ingredient**

Living Building Challenge Criteria:
 XXX-0000 EXP. 12/2010
 LBC ZONE 0 00 00 00
Declaration Status
 LBC Red List Free
 LBC Compliant
 Declared

MANUFACTURER RESPONSIBLE FOR LABEL ACCURACY
 INTERNATIONAL LIVING FUTURE INSTITUTE™ declareproducts.com

Intentionally simple in scope. By focusing on product ingredients, we hope to 'level the playing field' and create a platform for constructive conversations about the human health and ecological impacts of the decisions we make.

Options: Take back program; Salvageable or reusable; Recyclable (%); Landfill; Hazardous waste (%).

Raw Material and Final Assembly locations assist project teams in meeting the Appropriate Sourcing Imperative, intended to support the growth of regional economies rooted in sustainable practices, products and services.

All constituent parts of a product. Items are color coded to communicate potential hazards:
 Living Building Challenge Red List
 US EPA Chemical of Concern Action Plan Published
 ECHA REACH Substance of Very High Concern Candidate
 Not referenced in any of the three programs noted above

Temporary Red List chemical exceptions applied for specific product types.

Declare identifier for company + product
 Valid for 12 months, starting with the date of issue

CSI MasterFormat 2010 classification

Verification that a product complies with the Living Building Challenge Red List.

U.S. GREEN BUILDING COUNCIL MEMBER

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Here is an example of material documentation that can be used for LEED or Living Building Challenge. The Declare label is a standard format from Living Building Challenge for disclosing material ingredients. We'll talk more about Living Building Challenge next.

LBC: More In-Depth



The Living Building Challenge™ is the environment's most rigorous building performance standard. It calls for the creation of building projects at all scales that operate as cleanly, beautifully and efficiently as nature's architecture. To be certified under the Challenge, projects must meet a series of ambitious performance requirements over a minimum of 12 months of continuous occupancy.

LBC is quickly growing in interest and use.

Living Building Challenge Certification

Seven categories

- Site
- Water
- Energy
- Health
- Equity
- Beauty
- **Materials**



Coatings Fit in Materials “Petal”



This certification program has seven performance categories, known as Petals. Coatings fall under the Materials petal. They can also fall into the Beauty petal, but for this presentation we are only focusing on materials credit.

It also has something called the Red List. This List contains 22 materials or chemicals that cannot be used in a project based on toxicity concerns.

For example, asbestos is a Red List ingredient. Chromium is another Red List ingredient—and an example of where coatings manufacturers have responded with a chrome-free coating.

LBC Coating Disclosure

Self-Disclosure

- All product ingredients must be disclosed on Declare form
 - Up to 1% of ingredients can be claimed as proprietary

3rd-Party Verification

- All products must be either:
 - Red-list free or
 - Red-list compliant

Partner with Your Coatings Manufacturer



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The first step with any product is public disclosure. You must list all of the ingredients in your product on a Declare form. There is an exception—1% of ingredients can be claimed as proprietary.

After completing the Declare form, a 3rd-party organization is used to verify this disclosure. This step is administered by the International Living Future Institute.

Ideally, your product is Red-List free. This means your product doesn't contain any of the 22 materials or chemicals on the Red List. If there isn't a building product commercially available that is red-list free, then LBC will allow a red-list compliant product to be used.



COMPLETED: Learning Objective Three

Discuss how sustainability goals can be achieved with green coatings.

We just went through a lot of information about all of the organization actively involved in sustainability and what that means for coatings. It was fast, but I hope it provides you with a broad overview of this category.

Moving into our Fourth Learning Objective...how green coatings are used today.

Learning Objective Four

Identify key end uses for green coatings.

AAMA Specifications



AAMA 2605
70% PVDF

AAMA 2604
50% PVDF

AAMA 2603
Polyester

**High-Rise
Monumental/Residential**

- Curtain Wall
- Wall and Roof Panels
- Window, Door Frames
- Store Fronts

**High-End
Commercial/Condominium**

- Curtain Wall
- Wall and Roof Panels
- Window, Door Frames
- Store Fronts

**Commercial/Industrial/
Residential**

- Interior Extrusions and Panels
- Wall and Roof Panels
- Window, Door Frames

The good news is that there are green coatings available within each of the 3 main AAMA specification categories for coatings.

- Within AAMA 2605, there are high-performance green coatings for high-rise monumental and residential projects.
- Within AAMA 2604, there are green coatings that can be used on high-end commercial and condominium projects.
- And, within AAMA 2603, there are green coatings for commercial, industrial and residential use.



Green Coil Coatings



We talked a lot about solar-reflectivity coatings today when we discussed coil coatings and how those can be used on metal roofs. The science and energy savings behind this is well documented.

For building wall panels, a 3-year study in the coatings industry is underway to measure energy-savings when solar-reflective coatings are used.



Green Extrusion Coatings



If you think about a skyscraper with a curtain wall...you may not think that much about all the metal that is used. But that metal represents thousands of gallons of coating used both on the exterior and interior metal of the building.

Using a green coating can have a significant impact on extrusion products like curtain wall systems.



Use of Green Coatings Rapidly Growing

Green coatings continue to grow in importance every day within the architectural industry. You can expect that given the interest, coatings manufacturers will continue to innovate and introduce new innovations within this space every year.





COMPLETED: Learning Objective Four

Identify key end uses for green coatings.

With that, we've completed Learning Objective Four: identifying those key uses for green coatings within the architectural industry.



Course Learning Objectives

1. Present the basics of **coating ingredients** and performance.
2. Explain how **green innovations** in coatings create a more sustainable option for metal building products.
3. Discuss how **sustainability goals** can be achieved with green coatings.
4. Identify key **end uses for green coatings**.

And that brings us to the end of our session.

You've learned about coating ingredients and performance. We've talked about green innovations in coatings. We've discussed how green coatings can help meeting sustainability goals as outlined in some of the leading sustainability standards. And, we've talked about how there are green coatings that meet all of the AAMA specifications.



valspar
www.valsparinspireme.com

Contact Information
Robyn Ommen
rommen@valspar.com

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You can learn more about Valspar by visiting our website: valsparinspireme.com

Or, you can contact us at rommen@valspar.com

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