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Not Your Father's Stucco: EIFS and Topcoat Systems

BY ALLEN ZIELNIK, ATLAS MATERIAL TESTING TECHNOLOGY LLC

Using Exterior Insulation and Finish Systems (EIFS) is now one of the leading ways to renovate and aesthetically improve the façades and energy efficiency of existing commercial structures. They also offer design flexibility in adding architectural interest at relatively low cost to new construction. Not limited to commercial structures, EIFS is also increasingly being used in both single- and multiple-occupancy residential structures. Today, more than 1 million buildings in North America are clad with EIFS and account for over 30 percent of commercial structures. So what's the buzz about EIFS and what basics do you need to know about the materials and technology?

Shingle Creek Resort in Orlando, Fla. This massive resort property has numerous architectural features created by using EIFS. PHOTO COURTESY OF DRYVIT SYSTEMS INC.

WHAT EIFS IS … AND ISN'T

EIFS is not a structural wall but rather a non-load-bearing part of a wall facing the exterior. Although EIFS looks like stucco, a natural Portland-cement plaster, or other natural finishes, it is a synthetic product. Unlike stucco, EIFS can be made into large areas without any joints and in a wide variety of shapes and textures, although surface V-grooves are often used to visually break up large areas.

The basic components of an EIFS system are:

- An insulating layer consisting of rigid foam plastic boards and shapes; these are normally expanded polystyrene (EPS) or extruded polystyrene (XPS).
- A two-layer exterior coating system consisting of a paste-like, water-resistant adhesive and a plastic-coated, alkali-resistant fiberglass mesh that form the basecoat; and a crack-resistant, colored and textured, high-build, synthetic-polymer finish coat.
- An attachment system using water-based adhesive or mechanical fasteners, which holds the EIFS to the building substrate.

Unlike stucco, EIFS can incorporate mineral or stone aggregate additives to provide a wide variety of appearances. Also, it is easy to add three-dimensional embellishments such as moldings, cornices and cornerstones, and to combine different colors or textures.

The Morgan Stanley Building in Phoenix. PHOTO COURTESY OF BASF AND EIMA

Finishes are primarily trowel-applied, can be made with different textures and are frequently 1.5 to 3 mm thick. The foam insulation can be up to 4 inches thick, although local codes may allow for greater thickness. One inch is usually the minimum thickness. This depth allows for complex architectural design elements such as 3-D moldings. In addition, most EIFS is used in combination with a water-resistive barrier (WRB) which covers the wall to which the EIFS is attached.

EIFS is an above-grade material, and EIFS systems should terminate 8 inches above grade, according to most manufacturers' specifications. Also note that automatic landscaping sprinklers should be directed away from EIFS walls.

EVOLUTION OF EIFS

Pioneered in Europe following World War II, EIFS cladding was introduced into the U.S. in the late 1960s and was initially used on commercial buildings and, later, residential construction. These first systems, now referred to as "barrier" EIFS, were adhered directly to the exterior wall substrate and were in use into the 1990s. However, there were some notable early EIFS failures resulting from water entrapment behind the EIFS, which caused building damage or the growth of mold.

Although the EIFS, itself, can be impenetrable, sealants around penetrations and at the roof line can, in time, allow moisture to get behind the EIFS.

These problems developed because the original barrier systems relied on the unrealistic principle that the EIFS cladding can be a 100-percent-perfect water seal, on all substrates, for the life of the system. Although the EIFS, itself, can be impenetrable, in practice, sealants around penetrations and at the roof line can, in time, allow moisture to get behind the EIFS. Because of the low vapor-permeability of the finish, water trapped behind the EIFS does not dry out quickly. Limited drying potential in combination with high leakage rates can, therefore, lead to moisture buildup inside the wall, and eventually to mold growth and structural decay, especially in wood-framed structures. However, these barrier systems are available and can perform well in certain circumstances.

EIFS WITH DRAINAGE

Since the late 1990s, the majority of EIFS systems on commercial buildings are of the "drainage" type; these assume that water will penetrate the outer wall and provide some method for channeling this water out to the exterior. This may be achieved through an air gap between the EIFS system and structural wall, the use of non-woven mesh drainage material instead of an air gap or vertical channels cut on the inside of an adhered EIFS foam insulation. A secondary weather barrier is normally used on the face of the framing wall. Barrier and drainage EIFS systems are indistinguishable from one another by exterior appearance. It should be noted that there are other continuous insulation (CI) systems in addition to EIFS; these usually consist of foil- or film-faced foam boards which, when properly installed, form an air, water and insulating barrier.

EIFS can be installed over a wide variety of substrates, including concrete, concrete masonry

unit (CMU), tilt-up concrete, oriented strand board (OSB) and other sheathing. Both Portland-cement adhesives and non-cementitious adhesives (required for wood substrates) can be used for attaching EIFS systems; mechanically adhered systems use special screws appropriate for the substrate. The basecoats may be of acrylic polymer or polymer-modified cementitious adhesive with embedded fiberglass mesh.

Standard-, high- and ultra-high-impact mesh is available as suitable for the job. Some manufacturers use or recommend a second basecoat for high-impact-resistant applications. EIFS systems have also passed stringent Miami-Dade County Hurricane Tests (High Velocity Hurricane Zone), such as Parex HZ-EIF systems. It is recommended that the mesh and all other EIFS components be provided by the same manufacturer to ensure compatibility.

The Knickerbocker Commons project in Brooklyn, N.Y. features a façade insulation system with lotus effect technology developed by Sto Corp. PHOTO COURTESY OF STO CORP.

Polymer basecoats (PB) are typically 1/16-inch thick. Polymer-modified (PM) cementitious basecoats are typically 3/16- to 1/2-inch thick. Decorative, V-shaped grooves, which are not joints, can be cut into the foam prior to installing the basecoat. However, at no time can any portion of an aesthetic joint/ reveal be a flat horizontal surface. As both basecoat and finish-coat materials are water-based, they must be applied in temperatures above freezing. Most basecoats require at least overnight to dry, longer in cold or wet weather. In any case, the basecoat serves as the primary EIFS system water barrier.

Application of a primer is an optional step; installed over the dry basecoat, it enhances the performance and color of the finish. Some deeper finish textures, such as "swirls," require use of a tinted primer to eliminate the color of the basecoat from bleeding through. Primers also reduce the chance of efflorescence that may result from cementitious surfaces and help extend the coverage of the finish coat.

EIFS finish coats offer a wide range of colors, textures and appearance. The use of minerals, such as silica or mica, or stone aggregate can provide the look of limestone, granite and other natural stone as well as stucco, brick, field stone and even metallics. The most common commercial textures are "sand" and "swirl" with about 90 percent of installations having "medium" grade texture, which can hide minor substrate defects and provide a longer working time than finer textures. More aggressive textures can allow higher dirt pick-up and retention. The texture depends on both the material and the tools and techniques used to apply it.

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Other than colorants, minerals and aggregate, EIFS finishes are always 100 percent acrylic polymer. More durable grades are elastomeric acrylic or silicone-modified acrylic. While there are some spray-applied systems, the majority are trowel-applied. Acrylics are strong bonding, vapor-permeable, flexible and resistant to UV and weathering. The thickness is often determined by the mineral or aggregate size. Although EIFS systems themselves do not shrink, elastomeric finishes will more readily bridge cracks and prevent telegraphing to the surface, which may result from temperature changes or building movement. Silicone-modified acrylic finishes offer the increased UV-stability and water-repellency useful in some climates.

Photocatalytic, self-cleaning and hydrophobic (water-repelling) topcoats such as Sto Corp.'s Lotusan based on the lotus-effect and Parex's AquaSol hydrophobic and photocatalytic products have also emerged on the market. These offer reduced dirt and soot pick-up and reduced mildew growth through either self-cleaning or photocatalytic effects to improve appearance and reduce cleaning maintenance, especially in hot and humid environments or environments subject to diesel hydrocarbon or wildfire soot.

Water-based finish sealers such as Dryvit's SealClear can provide additional protection to vertical surfaces. These are usually non-yellowing and non-whitening, clear-drying, 100-percent acrylic in order to help reduce dirt pick-up and provide increased water repellency and mildew growth.

EIFS MAINTENANCE AND RECOATING

EIFS topcoats are extremely durable and normally maintain their color and appearance very well. However, annual inspection and repair of damage is highly suggested. Cleaning is usually carried out with low pressure wash with a manufacturer-approved detergent. High pressure or hot water should never be used, as the heat resistance of EPS is limited to about 160 degrees Fahrenheit; nor should any solvent-based product be used. The temperature limit also can restrict the use of dark colors in hot, sunny climates.

EIFS substrates can receive ornate treatments. PHOTO COURTESY OF DRYVIT SYSTEMS INC. AND EIMA

Following any repairs, or to renew the finish appearance, the most common way to maintain appearance is to apply an acrylic or elastomeric coating to add luster and protect the EIFS finish. Another approach is "over-cladding," which requires thorough cleaning followed by the application of a new skim coat with a non-cementitious basecoat to smooth the surface, and then application of the new finish material.

While over-cladding is often the preferred method for renewing the surface or changing the color, painting the surface is also an option, according to the EIFS Industry Members Association (EIMA). Deep-texture EIFS are more difficult to paint and require thick-nap rollers Realize that painting will almost always reduce the surface texture and can result in a more plastic-like appearance. Quality paint should be used; if the paint does not adhere well, this will limit future recoat possibilities. The use of 100-percent acrylic paints in flat or satin is usually recommended; however, acrylic or silicone-modified elastomeric products provide better crack bridging and usually have longer life. Recoating often requires two coats for complete coverage. The use of an elastomeric basecoat followed by an acrylic second coat is another alternative. In any event, as with roof coatings, a surface refinish or recoat cannot improve a structurally poor substrate.

CONCLUSION

EIFS has proven, especially in commercial buildings, to be a durable, versatile, good performing product. That being said, however, the success of any installation is dependent not only on the quality of the materials but also on the execution of the installation. While there are many good manufacturers of EIFS system components and aftermarket products, selecting systems, rather than components, usually results in the best outcome. The quality of workmanship, especially in terms of waterproofing the load-bearing wall, sealing the foam-board joints, properly applying the mesh, and applying the base and finish coats, will ultimately determine the outcome of the project. Contractors that have experience with and have been specifically trained on the system being used should be utilized. And realize that the success of the project is also highly dependent on the ancillary systems of flashing and sealant installation. But a properly designed, installed and maintained EIFS system can be beautiful, functional, durable and energy-efficient for many years.

ABOUT THE AUTHOR: Allen Zielnik has 40 years of experience in both chemical and physical instrumental methods of analysis of materials. He has been with Atlas Material Testing Technology for the past 22 years, specializing in the effects of solar radiation, weather and the environment on the durability and performance of materials and products, including coatings. A frequent speaker at various worldwide technical symposia, he is the author of more than 120 publications and conference presentations. Zielnik has degrees in electronics engineering and analytical chemistry.

Tagged categories: Aesthetics; Coatings Technology; Color; Design; EIFS; Stucco; Texture

Comment from David Boivin, (2/5/2016, 8:45 AM)

Thank you Allen. A very well written and comprehensive article. EIFS provide a very simple way for designers to meet the new energy codes, with a great cost benefit ratio, and unlimited design flexibility.

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