Acrylic Coatings: Not Just Paint

More than a go-to finish coat, acrylics offer excellent protection for the building envelope.

By George Daisey, The Dow Chemical Co.

Not all polymers are acrylic, and not all acrylics are appropriate for every application. But they’re more than just color coats, and the right acrylics in the right place and proper formulations can work throughout the building envelope — from adhesive and sealant to air barrier and roof coating.

For instance, not many people realize acrylic polymers may coat the fibers of fiberglass insulation in wall cavities.

Acrylic polymers are resins that can be formulated into coatings for a wide variety of applications. Along with their well-known role in paint, acrylic resins provide a basis for clear furniture finishes, driveway sealers, caulks, deck coatings and much more.

They make products tough and hard, flexible and soft, and anywhere — and everywhere — in-between. Particularly in the building envelope, acrylics can impart durability, protection and a barrier to water and air leakage.

Since the kind of acrylic coatings we are speaking of are water-based, this makes them useful in regions with volatile organic compound (VOC) restrictions.

Strength in Monomers

The term acrylic, properly used, refers to a macromolecule, or “polymer,” made of two or more acrylic molecules, or “monomers,” each with its own characteristics. For example, methyl methacrylate (MMA) is a monomer that brings hardness and toughness to acrylic formulations. Butyl acrylate (BA) provides a gooey stickiness.

Joined by chemical reaction in a water carrier with an “initiator” and a surfactant, the monomers create an acrylic polymer resin with characteristics of the monomers. Depending on how much of
each monomer is used, the resulting resin could form the basis for a sealant that comes out of the tube gooey and sticky, but cures tough and durable, yet with the flexibility to accommodate building movement.

Add more MMA and you get the foundation for tough coatings suitable for a gymnasium floor or a metal storage tank.

Add non-acrylic and other functional monomers to the chemistry toolkit and you have nearly limitless potential to create high-performance coatings and other products for the building and construction industry with a variety of properties and end uses.

In general, acrylic polymer resins can account for about 30 to 40 percent of the content of the coatings in which they’re used; this level varies greatly depending on the type of product, so it could be lower or even higher. Other elements include pigments and additives such as dispersants, defoamers and coalescents. Manufacturers may add biocides for stopping biological growth in the container as well as on the project.

Tg is an acronym for glass transition temperature. Tg describes the “hardness” of acrylic polymers at a given temperature. If a polymer’s ratio of hard to soft monomers is high in a hard monomer like MMA, then the Tg of the final polymer will be high and vice versa.

Theoretically, if weather causes the polymer’s temperature to dip lower than its reported Tg, then the polymer will be hard and brittle. A polymer with a Tg of 110 F (43 C) will stay hard as long as the temperature is 110 F or below. If the temperature of the polymer rises above the reported Tg, then the polymer becomes rubbery and elastic. For applications where the coating must stay flexible even at low temperatures, then the polymer Tg is low. In reality, Tg is more of a range than an exact temperature, so the point where a polymer becomes more or less flexible can vary over a few or several degrees.

Caulks, sealants and roof coatings are examples of low-Tg applications that must stay flexible at low temperatures. Applications where the coating must stay hard, even at higher temperatures, include furniture coatings, floor polishes and coatings for exterior metallic surfaces.

Contractors and specifiers might find an understanding of Tg useful in working with manufacturers to find the most appropriate products for their projects, since Tg is not information that usually appears on labels or other commonly available product literature. There are plenty of effective sealants on the market, but if your project will face extremely high or low temperatures, understanding Tg could help with product selection.

Now let’s take a look at a few places where acrylic coatings can be found in and on the building envelope.

Acrylics on the Roof
Acrylic elastomeric roof coatings are liquid-applied, seamless, fully adhered membranes that are formed in situ on the roof. These coatings are usually installed at 18 to 20 dry mils minimum. High-quality installations may be applied at 30 dry mils or more. Some installations are coating-only, while others combine fabric designs into the coating matrix, creating a durable roof membrane. Acrylic technology is widely used in exterior coating applications because of its durability.

The coating’s acrylic polymer component adheres the coating to the roof, as well as binding together other important
Ingredients such as pigment. The white pigments in elastomeric coatings protect the roof by reflecting most of the visible and infrared wavelengths of sunlight, although they do absorb some of the ultraviolet (UV) component of sunlight — about 5 percent of that spectrum.

As the binder, the acrylic polymer encapsulates and holds the pigment in place so it can do its protective work. The transparent acrylic binder, however, does not absorb UV, and so is virtually unaffected by it. UV exposure and absorption can degrade some non-acrylic binders, causing those coatings to loosen their grip on roof and pigment.

For example, when asphalt-based coatings absorb radiation, the molecules energize and begin to vibrate. Eventually the molecules fragment. Sometimes, within as little as six months, there’s a brown, chalky residue on asphalt-based roof coatings where UV has broken down the non-acrylic binder, leaving pigments to weather away, further reducing resistance to UV.

UV-resistance is an important characteristic for roof coatings, since no part of the building envelope gets hit by UV like the roof does.

Acrylics are durable and can be used over a variety of roofing surfaces. But not every acrylic is good over every surface.
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For instance, acrylic roof coatings should not be applied over new TPO, new PVC or silicone. Don’t apply acrylic roof coatings to Kynar except with a proven specialty primer compatible with the acrylic coating.

Reading the label, talking with a manufacturer’s rep and studying literature go a long way toward picking the right product.

### Acrylics in Composite Wall Systems
Often referred to as EIFS (exterior insulation and finish systems) or ETICS (external insulation composite systems), these sophisticated wall systems, constructed correctly, provide durability, insulation and protection.

You can find acrylic polymer technology in several layers of the EIFS assembly. The basecoat, adhesive and finish coat layers of the assembly all can contain acrylic polymers. The function of the acrylic polymers in these applications is to deliver adhesion, water-resistance, hydrolytic stability and durability.

The basecoat and adhesive coats disappear from view as the EIFS assembly is put together, but everyone sees the finish coats. Color stability, color retention, efflorescence-resistance and dirt-pickup-resistance are additional properties that acrylic polymers are engineered to deliver in finish coats.

### Acrylics in Caulks and Sealants
Acrylic caulks and sealants are widely used for sealing joints, cracks and other gaps in the building envelope.

Caulks create barriers to air, dust, moisture or heat. Sealants are caulks that withstand extension and compression cycles without losing effectiveness. A good acrylic sealant will have excellent adhesion, durability and dirt-pickup resistance; low modulus or stiffness; high flexibility and elongation; and the ability to move with the joint it is sealing.

One key advantage of acrylic sealants is that they are paintable. Acrylic sealants can be found in products from non-spec to ASTM C834 Standard Specification for Latex Sealants to ASTM C920 Standard Specification for Elastomeric Joint Sealants Class 35.

### Acrylics in Air Barriers
Air barrier coatings are a fast-growing market for the building envelope. Air barriers were once limited to polymeric membranes such as spun-bonded olefins, but coatings have progressed quickly to become a viable option for air barriers. Building codes are embracing these high-quality air barrier coating systems.

Acrylic polymers are ideal for fluid-applied air barriers, because they deliver excellent adhesion, bulk water-resistance, vapor permeability, high elongation and crack-bridging. A fluid-applied air barrier eliminates the need for mechanical fasteners, creating a more monolithic air barrier with no penetrations or air leakage. Depending on the liquid air barrier, joints may...
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require a separate treatment, which might be a coating, tape or mesh.

On the other hand, no one product fits all. There’s no substitute for proper analysis of the building science and understanding what’s going on in that building, then making the proper recommendation for an air barrier on that basis.

Organizations like the Air Barrier Association of America are great resources for learning more about acrylic air barrier products and other options.

**Acrylics in Cement, Stucco and Renders**

Many acrylic polymers will not work in a cementitious system, but there are custom acrylic polymers designed just for that and those are the ones you will find in acrylic-modified cementitious systems.

Acrylic polymers specially made for the highly alkaline, high-divalent-ion concentration of cementitious systems can transform cementitious systems for patch and repair, decorative concrete, stucco, renders and adhesives into high-performance systems. Acrylic technology enhances the wet adhesion, durability, flexibility and toughness of these systems. One particular improvement is that acrylic-modified cementitious systems can be applied in much thinner applications than non-modified systems.

That is helpful in patch and repair, stucco and renders, where thinner coats can be applied without concern for poor hydration of the cement. Thin applications are nearly impossible with unmodified cementitious coatings, because it is a challenge to keep the Portland cement component properly hydrated.

These specialized acrylic polymers encapsulate the cement particles, retaining the moisture and allowing the cement to cure more evenly and completely. That helps deliver the cited performance enhancements.

**The Right Tool for the Right Job**

Acrylic polymer-based coatings are by no means the only coatings solutions available for the building envelope, but they are widely used, particularly where water-based products are called for. They are also the highest-performing of the water-based chemistries.

No matter which acrylic products are used in the different parts of the building envelope, it’s important to understand that each has its own performance specifications and is formulated to meet those requirements. Contractors, architects and specifiers all want to recommend the right products for the job. Most company reps want to sell you the correct product. Nobody likes callbacks.

Going beyond the sales reps and calling manufacturers’ tech line support numbers can be helpful. You often get people with good technical backgrounds who understand how the products perform and should be used. If the person you call doesn’t know, they’ll likely put you in touch with someone who does. A little research can help you identify with precision the correct acrylic for your application.

**About the Author**

An expert in elastomeric roof and wall coatings, George Daisey is a research scientist in the Dow Construction Chemicals business unit at The Dow Chemical Co. He earned a bachelor’s of science in chemical engineering and a minor in chemistry from Drexel University. Daisey holds a U.S. patent in exterior latex stains. A New Jersey resident, Daisey’s memberships include ASTM International, the Philadelphia Society for Coatings Technology, CRRC, RRCI and the RCMA.
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