

# The Use of Bonding Agents for Portland Cement Plastering

By Jeff Larsen

**B**efore we had liquid chemical bonding agents, we had to provide some form of mechanical key to ensure the bond of portland cement plaster. In the early 1950s, water-based polymers became available to treat surfaces to be plastered. By the late 1950s, we had acrylics that modified the plaster itself. Thus we have two basic categories of bonding agents: surface applied and integral.

Almost all surface applied bonding agents are compounded from polyvinyl acetate emulsions. These water-based adhesives are very safe to use because they are non-toxic, non-hazardous and non-flammable. They meet even the most stringent VOC requirements.

## Pre-Application

As with any coating, surface preparation is essential for a successful application. The surface must be structurally sound and clean, which means free from dust, dirt, oil and efflorescence.

On new concrete it is important to determine whether the form release and/or curing compound can be coated. Almost all manufacturers of these types of products will include a statement in their directions regarding compatibility with various coatings. If the surface can be painted, it can be coated with a surface applied bonding agent.

## Application Tips

Coverage for surface applied bonding agents varies between 200 and 300 square feet per gallon, depending on the surface, viscosity

of the bonding agent and the method of application. Surface applied bonding agents can be applied with a brush, roller or sprayer. Experience has shown that for spray applications, commercial spray equipment is the most suitable. Heavy-duty airless equipment also has been used. Do not thin a water-based bonding agent or you risk adversely affecting the solids content and ultimate performance.

The surface may be dampened lightly to reduce drag on the brush or roller. Very dry or old concrete-or any surface that is extremely porous-should be dampened prior to application to reduce excessive absorptions. Surface applied bonding agents are often applied over concrete masonry to equalize suction and prevent joints from shadowing through.

## Post-Application

After applying the bonding agents, there should be a clean, uniform film over the entire surface. Most bonding agents have been tinted to aid in inspection. Care should be taken to protect surrounding surfaces. While still wet, PVA bonding agents can be removed with hot water—the hotter the better. Once dried, PVA films are difficult to remove and may require solvents, mechanical abrasion; heat and/or very exotic chemicals to do so.

Once the bonding agent has been applied, it is important to understand the two basic types of surface applied bonding agents. One type is a pre-plasticized PVA co-polymer and the other is a pre-plasticized homopolymer. The principle difference

between the two is that the PVA co-polymer should not be allowed to dry before the plaster is applied. The time the co-polymer will remain tacky is dependent on these factors: how the bonding agent was compounded, the thickness of the application, the substrate and the air temperature. If a PVA co-polymer dries before the plaster is applied, it will act as a bond breaker, not a bonding agent.

## The PVA Homopolymer

The second and most important prevalent type is the PVA homopolymer, which allows for the bonding agent to dry and the plaster to be applied hours-even days-later, provided the film is protected from contamination. The bond is accomplished by the mechanical penetration of the bonding agent to the substrate, the adhesive bond created by the bonding agent drying on the substrate and the chemical reaction of the bonding agent with the portland cement plaster. The dry bonding agent film is activated by the moisture in the new plaster. The strength of the adhesion is developed as the plaster and the bonding agent dry together.

On two-coat work, only the base coat is bonded to the substrate. It should be at least three-eighths of an inch thick and permitted to dry a minimum of 24 hours. This is extremely important. If the second coat is applied too soon, the moisture may penetrate the scratch coat and flood the still wet bonding agent and cause a delamination. On applications where a machine- or hand-applied dash coat is going to be used,

make sure the dash coat is firm before applying a minimum three-eighths of an inch finish coat.

## One More Question

A frequently asked question about homopolymer-polymer-based PVA bonding agents concerns water resistance: How can a bonding agent that is reactivated by the moisture in the plaster be resistant to water after the plaster has been applied?

Actually, PVA homopolymer bonding agents (also known as Type I bonding agents, as they are referred to in the ACI Committee report on bonding agents) can be formulated to give better water and alkali resistance than PVA co-polymer or Type II bonding agents. This fact has been substantiated in a report by K. A. Safe of Vinyl Products, Ltd. of Great Britain: "It does appear that the old apprehensions about the unsuitability of polyvinyl acetate emulsion for use as bonding liquids, where conditions

of damp or alkali might be met, are quite unfounded. In no case did more waterproof polymers give better results." And, from the aforementioned ACI report: "This type of adhesive (referring to Type I adhesives) has been successfully used without apparent problems in areas exposed to moisture."

The applicable ASTM standard for surface applied bonding agents for exterior plastering is C-932. This standard establishes physical requirements for the bonding agent both in packaging, in its liquid state and as a dried film. ASTM C-932 establishes a minimum tensile bond strength of 150 psi. This standard also establishes a flexibility standard for the film, a high temperature test, and freeze/thaw stability. Most surface applied bonding agents are compounded to be freeze/thaw stable through five cycles.

If you encounter a pail of frozen bonding agent, allow it to thaw at room temperature. Once thawed, stir

it thoroughly; do not mechanically agitate the contents back into a homogeneous blend.

## Integral Bonding Agents

For applications of portland cement plaster less than 3/8", it is best to use an integral bonding agent. Cement and sand mixes to which integral bonding agents have been added are referred to as modified portland cement mortars.

Acrylic Emulsion. There are many variations of lattices and formulations used to modify a portland cement mix. The type used most often in plastering is an acrylic emulsion. These are white, milky liquids that are typically diluted with water, depending on the solids content of the acrylic in the emulsion. Proportions vary from one-part acrylic to one-part water up to one-part acrylic to three-parts water. Acrylic and

water are first mixed together and then added to the dry sand and cement mixture. All ingredients are then thoroughly mixed.

Acrylic-modified mortars provide a lasting bond and the strength of portland cement matrix also is substantially improved. By adding the acrylic polymer to the mix, the plaster becomes self-curing. The acrylic allows complete hydration of the mortar because of its ability to attract and hold water. Acrylics also form a surface skin that reduces evaporation. In thin applications, less than half an inch, this is of particular value.

Acrylic-modified plasters have increased tensile and flexural strength and are more water- and chemical-resistant than unmodified plasters. The problems of dusting and dryouts also are eliminated with the use of acrylics.

It is acceptable to use acrylics as part of a machine- or hand-applied dash coat prior to a finish coat, but it is important to remember that acrylics cannot be used as surface applied bonding agents. Just as PVA co-polymer surface applied bonding agents will act as bondbreakers if they are allowed to dry before the new plaster is applied, the same is true for acrylics. Even if the acrylic emulsion has not been allowed to dry, the film is so thin and brittle it rarely improves the bond.

## Miscellaneous Considerations

Even though the vast majority of acrylic emulsions are clear, they do seem to have an effect on the final color of portland cement plaster. If acrylics are being considered with a colored stucco, be aware that the acrylic will affect the final color. It is probably a good idea to submit a finished sample for approval, and then meticulously maintain the water-to-acrylic ratio throughout the job.

## Common Questions

Should modified portland cement plasters be used in conjunction with surface applied bonding agents? If one bonding agent is good, wouldn't

two be even better? No. A surface applied bonding agent needs the moisture in the plaster to reactivate the film. A plaster modified with acrylics does not allow the moisture to reactivate a homopolymer film.

One situation where the two types of bonding agents are compatible is when the substrate to receive a portland cement plaster finish needs to be tightened or consolidated—for example, the finish coat of a previous two- or three-coat job has delaminated, leaving a crumbling base coat. The base coat can sometimes be rehabilitated by spraying an acrylic emulsion and allowing it to dry. It is here that either a surface applied bonding agent or an integral bonding agent can be used. The object in this case is to achieve a sound surface on which to bond. *CD*

### *About the Author*

Jeff Larsen is president of Larsen Products Corp., Jessup, Md.