To Paint or Stain?

by Charles Wardell

One of my springtime rituals used to be repairing the exterior of a client's 20-year-old vacation cottage. The trim, siding, doors, and exterior decking had all been coated with an opaque stain, then recoated after perhaps a decade. By the time I arrived on the scene, the grain on just about everything had long since separated. Every exterior door had swelled and warped, while the trim and siding had cupped and cracked. Each April, I'd get the inevitable call informing me that a few more pieces needed repair.

My clients had stained everything because they wanted the house to look rustic and informal. The problem was that they also expected the stain to last as long as a good exterior paint system. Following popular conception, they figured the oils in the exterior stain would penetrate the underlying wood, helping to restore and preserve the old siding and trim.

But how well do exterior stains really protect wood? I put that question to a number of people in the coatings business — manufacturers, researchers, and house painters. The consensus was that stain *can* extend the life of exterior wood, but not in quite the way or for quite as long as many people believe. What most people don't know is that exterior stains are little more than thinned paints. Fully understanding this will help you get the most from a stain; misunderstanding this will only guarantee failure.

A stain, such as the opaque oil-based product applied here, will need to be recoated sooner than a paint on smooth clapboards. Stains work best on rough-sawn siding.

Paints

House paint (and stain) is a mixture of finely ground solids dissolved or suspended in a liquid solvent. The solids used in all paints (whether oil-based or latex) include pigments and resinous binders. Most exterior paints also have a number of additives mixed in (antifreezes, mildewcides, and drying oils are the most common ones).

Pigments add color and determine gloss, while the binder forms a film that knits the particles of pigment together and, given a good prep job, sticks to the underlying surface. The solvent evaporates as the paint dries, leaving the solids behind as a thin (.002- to .003-inch-thick) surface film. Oil paints use petroleum-based hydrocarbon or natural oil solvents; latex paints use water along with small amounts of oils.

Oil and Water

Oil-based paints have been around for a couple of centuries. American colonists coated their homes with a mixture of linseed oil and pigment — a hard-to-spread, slow drying, short-lived finish that formed a comfortable breeding ground for mold and mildew. Paints got a lot better over the next few centuries, but most still used linseed oil binders. The biggest change came during the 1940s, when paint manufacturers began replacing linseed oil with synthetic resins called alkyds. Alkyd paints spread more easily, dry faster, last longer, and are more resistant to mold and mildew.

Latex paints hit the market about the same time as alkyds. Most of the early latexes used vinyl-based binders. They were easier to use than the alkyds, but less durable, and thus earned a reputation as a cheap homeowner product. But paint manufacturers have made great strides in quality since then. The secret lies in acrylic binders.

Paint offers the best overall protection, but certain types of stain, applied properly, hold a close second

Acrylics have all the advantages over alkyds that alkyds originally had over linseed oil — and then some. The improvement has to do with the different ways acrylics and alkyds form a surface film. An alkyd paint forms an impermeable film through constant surface oxidation, a process that can go on for the life of the paint. This process causes alkyd films to lose their color over time, while making them ever more brittle, and ever more likely to crack and flake. Acrylic paints, on the other hand, don't undergo chemical reactions as they dry; the acrylic particles simply draw together as the water evaporates, forming a stable yet flexible film that can expand and contract with the underlying wood. At the molecular level, this film resembles a fine mesh that's loose enough to pass vapor but tight enough to shed liquid water. Acrylic paints hold their color longer than alkyds and are less susceptible to cracking. That makes them ideal for building exteriors.

Of course not all latex paints are all-acrylic. A 100% acrylic paint is expensive — $20 to $30 a gallon, depending on where you live and what particular paint you're buying. Some manufacturers offer less expensive paints with binders consisting of a mixture of acrylics and vinyls. The tradeoff is that these mixtures are less permeable, less flexible, and less durable than 100% acrylic paints. Mixtures provide a false economy at best, and are seldom used by professionals who guarantee their work.

Many painters also resist switching to acrylic primers — even though most have been won over to acrylic topcoats. A primer is supposed to form a stable base to spread the topcoat over (see "A Primer on Primer"). Because alkyd primers contain oils that penetrate and seal the wood grain, most painters believe that they adhere to the wood more tightly, thus forming a more stable base than a latex.

One of the biggest strongholds for alkyd primer is on old houses. Con-

Figure 1. *An old house is a good candidate for an alkyd primer and a latex topcoat. The painter scraped the loose paint from this house in Burlington, Vt., (top), then power-washed the surface before coating it with an alkyd primer and two coats of a 100% acrylic paint. The result (above), shown five years later, has yet to show any signs of peeling.*

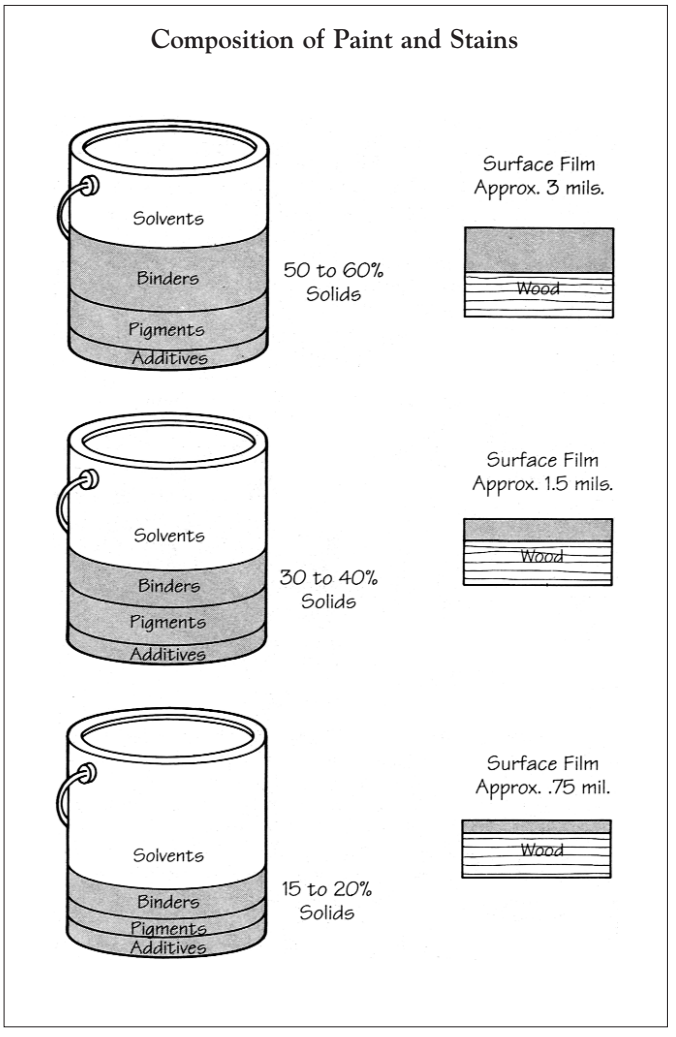

Figure 2. *Paints and stains are essentially the same ingredients in different proportions. All are a mixture of finely ground solids — pigments and binders — dissolved or suspended in a liquid solvent. The solvent evaporates, leaving a surface film that varies in thickness depending on the amount of solids in the coating.*

ventional wisdom says that the best coating system to use over old, weathered oil-based paint is an oil-based primer followed by an acrylic topcoat. This system has proven to be exceedingly durable (see Figure 1).

Despite the strong appeal of penetrating primer, however, some painters are experimenting with sealing acrylic primers, which seem to perform at least as well as their alkyd counterparts, even though they don't penetrate. For example, painting contractor Wayne Hallstrom tried an acrylic primer on an old house in Burlington, Vt., a couple of years ago. The existing trim and siding paint had cracked extensively, and would have absorbed two full coats of an alkyd primer. But the acrylic he used covered it in one coat, forming a consistent film that effectively spanned the cracks. How the system will perform over time remains to be seen, but Hallstrom reports that after two years it seems to be holding up as well as an oil-primed job.

Oil-Based Stains

Exterior oil-based stains came along during the 1960s. They've been a successful product, to say the least. In fact, stains have been marketed so aggressively that many people have come to view them as an improvement over standard house paint. This marketing effort bore its greatest fruit during the housing boom of the 1980s when, as one manufacturer put it, "we saw stain taking over the market for house paint."

Mixtures of acrylic and vinyl provide a false economy. If you spec latex paint or stain, use only 100% acrylic formulations.

Stains can be either semitransparent — letting the wood grain show through — or opaque, like paint. Opaque stains are available in oil or latex formulations, while semitransparent stains are generally oil-based. Both products are basically thinned paints: They contain the same list of materials — binders, pigments, and additives — but in different proportions (see Figure 2). The difference between paint and stain is merely the difference in the percentage of solids they contain: 50% to 60% for paints, 30% to 40% for opaque stains, and 15% to 25% for semitransparents. Even semitransparent stains include a binder, so that they too form a very thin surface film (about .00075 inch).

The biggest advantage of stains has always been an aesthetic one. While paint forms a thick, smooth finish, a coat of stain is thin enough to reveal the underlying wood. Semitransparents let the actual grain show through, while opaque stains obscure the grain but not the texture of the wood.

Stains have other advantages, too. The thin coating formed by a stain is less likely to peel or alligator than a coat of paint (though they're not immune from such problems). And oil-based stain is an excellent finish for rough siding (see Table 1, "Expected Life of Exterior Coatings"). Because it is thinner than paint, it brushes on easier, coating all the surfaces. On smooth siding and millwork, a stain has to be reapplied more often than paint, but it's much easier to prep.

For coating cedar and redwood siding, most professionals recommend opaque oil stains rather than semitransparents. When these woods become wet, the extractives contained in their heartwood can dissolve and migrate to the surface, where they appear as a gray to reddish-brown discoloration. Semitransparent stains are just too thin to block these extractives. However, this is only a problem with light colored-stains; the discoloration is not visible on dark-stained surfaces.

Opaque, or solid-color, oil stains are less likely to discolor because they're thicker. But that same thickness also makes them more susceptible to peeling failures.

With inadequate prep work, such failures can show up relatively soon after a house has been coated, as witnessed by Chris Monahan of National Home Inspection of New England in Newton, Mass. After 15 years in the business, Monahan has seen a lot of peeling stain, including massive failures on four-year-old houses. "I see the same sort of peeling failures with solid stains as I do with paints," says Monahan. "People use stain thinking that they're not going to get the same types of problems that they do with paint, but they're kidding themselves."

The only advantage Monahan sees to such a thin film is that it's easier to remove when it does fail. "You can almost scrape it off with your hand," he says. Monahan suspects that because most people don't realize that opaque stains are really thinned paints, they apply them to bare wood with no primer. The stain has no base to adhere to, so a few years later the house needs recoating.

If you're putting an opaque latex stain over cedar or redwood, use a special stain-blocking primer first

Monahan's observations are supported by research from the American Plywood Association (APA). After a six-year study of various coating systems, the APA has concluded that some solid-color stains will hold up over time only if applied to a primed surface. The big culprit here is ultraviolet light: the film formed by a seemingly opaque stain is still thin enough to transmit ultraviolet light, breaking down the binder and driving the finish to premature failure.

Latex Stain

The lion's share of the stain market has always gone to the oil-alkyds. Given the success of acrylic latex paints, however, it's no surprise that acrylic stains — both semitransparent and opaque — have been catching up. But the very notion of a water-based stain defies conventional wisdom. After all, a water-based product has no oils to preserve the underlying wood, so it can't really be called a stain. Or can it?

"You really can't compare a latex stain to an oil-based system," says Bill Feist, a chemist in charge of wood finishing research at the Forest Products Laboratory (FPL) in Madison, Wis. One reason he cites is penetration. Like most experts, Feist concludes that all oil-based coatings penetrate the wood somewhat, and that this, in turn, promotes adhesion. But according to Feist, nobody fully understands penetration because it hasn't been studied in great detail. It may turn out to play less of a role than commonly believed.

Feist and other coatings experts assert that the life of any coating system depends largely on the quality of the product. This is especially true for latex products because there can be so much variation in the formulations.

"You have to be careful with the term 'latex stain,' " echoes David Thompson, an architectural representative with the California Paint Company, "because it usually refers to the less durable vinyls or vinyl acrylics; 100% acrylic stains, on the other hand, perform much better."

Different painters have had different experiences with latex stains. Some love it, some hate it, and some just don't know what to make of it.

Kevin Nolan, a painting contractor in Ardmore, Penn., is an acrylic latex fan. He says it's easier to apply, more consistent, and more durable than oil-alkyd stains. Nolan claims it's also more uniform, absorbs more evenly, and doesn't separate in the can. And, he says, acrylics hold their color better.

But latex can be a hard sell. Many clients still equate water-based products with cheap interior paints. For this reason, Nolan stresses the word "acrylic" to his clients while explaining its strengths. He backs up his assertions by showing them a home he coated with an acrylic latex stain four years ago. The stain looks as good as when it was first brushed on, while an oil stain applied around the same time to a nearby home has faded considerably.

Richard Conover, a painter from Martha's Vineyard, Mass., echoes many of Nolan's assertions. Not only do acrylic latex stains hold their color better, he says, but the colors themselves are much brighter. Latex also dries fast enough to let him recoat the same day. "In this day and age, when budgets are tight," he says, "it's the way to go." Conover also appreciates the fact that, compared to alkyds, latex products contain relatively few volatile organic compounds, or VOCs (the carbon compounds used in oil-based paints that form ozone when they evaporate). That's a big selling point with some clients. Latex stain's biggest positive, though, is its moisture permeability. In the damp seacoast climate where Conover works, that can be a real advantage.

Still, many professionals have reservations about latex stains. Conover, for instance, voices the same list of gripes about latex

Table 1. Expected Life of Exterior Coatings

Type of exterior wood surface	Semitransparent stain[1]	Solid-color stain[2]	Paint[2]
Siding			
Cedar and redwood			
Smooth (vertical grain)	2-4 yrs.	3-5 yrs.	4-6 yrs.
Roughsawn	5-8	4-6	5-7
Pine, fir, spruce			
Smooth (flat-grained)	2-3	3-4	3-5
Rough (flat-grained)	4-7	4-5	4-6
Shingles			
Sawn	4-8	3-4	3-5
Split	4-8	3-4	3-5
Plywood			
Sanded	2-4	2-3	2-4
Textured (smooth)	2-4	2-3	3-4
Textured (roughsawn)	4-8	3-5	4-6
Medium-density overlay	*	5-7	6-8
Hardboard (medium density, unfinished or preprimed)			
Smooth	*	3-5	4-6
Textured	*	3-5	4-6
Millwork (usually pine)			
Windows, shutters, doors, exterior trim	2-3	3-4	3-6
Decking			
New (smooth)	2-3	1-2	2-3
Weathered (rough)	3-6	1-2	2-3

* Should not be used.
[1] Smooth, unweathered surfaces are generally finished with only one coat of stain. Roughsawn or weathered surfaces, which are more absorptive, can be finished with two coats; the second coat is applied while the first coat is still wet.
[2] Expected life of two coats, one primer and one topcoat. Applying a second topcoat

The expected life of an exterior finish depends on the substrate it is covering, as shown in this chart compiled by the Forest Products Laboratory in Madison, Wis. The predictions are for average locations in the continental U.S. The coating life of a given job will vary with climate and exposure. (Adapted from "Exterior Wood in the South: Selection, Applications, and Finishes")

A Primer on Primer

Water and ultraviolet light are the biggest enemies of exterior wood, but a good paint job will protect against both. The binder in a paint seals out water, while the pigments form a shield against ultraviolet light. No single coating has enough binder and pigment to do both, however, so manufacturers formulate paints in matched systems of primers and topcoats.

A primer contains a higher ratio of binder to pigment than a topcoat. The binder forms a protective surface film that clings effectively to the underlying wood. The added binder also enables primers to seal in extractives and keep the wood from unevenly absorbing the topcoat.

Because it increases binder at the expense of pigment, a primer's film is thicker, stronger, and more resistant to moisture. But the reduced pigment means that the primer lets more ultraviolet light through, which eventually weakens the bond. That's where a good topcoat comes in. A topcoat contains more pigment, but less binder, than a primer. The topcoat's job is to shield the wood from the sun's ultraviolet rays.

In such a system, each layer of paint compensates for the other's weakness. Manufacturers carefully match primers and topcoats to provide an optimum level of protection, so it's best to use a primer that is recommended for a particular topcoat. A mismatch can significantly shorten the life of a paint job.

— C. W.

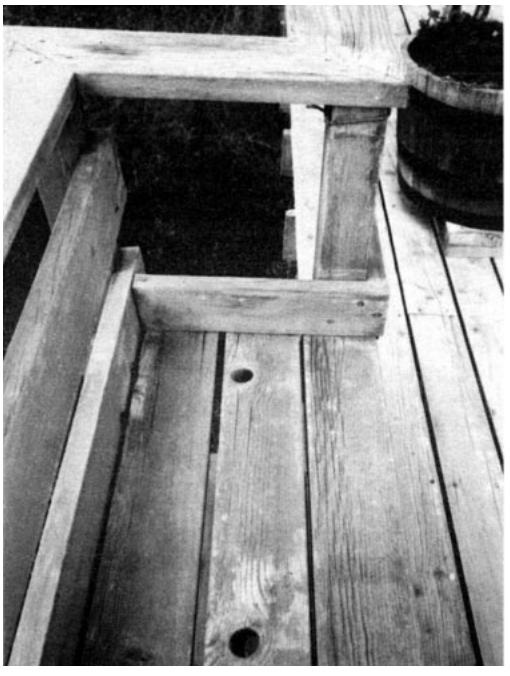

Figure 3. *On a stained deck it's hard to tell if the wood has suffered moisture damage, because the stain doesn't peel noticeably. This deck (left) looked okay to the homeowner until the day someone stepped through a rotten board. Paint, on the other hand, peels visibly when it is failing to offer protection (above).*

stains that painters have with water-based products in general — namely that latexes set up too fast and won't keep a wet edge, especially in hot or windy weather. That makes it crucial to stop and start work at natural breaks in the building facade to avoid visible lap lines. And because acrylic stains are thicker than alkyds, they don't level out as well and are harder to control when spraying. Painters also cite problems when recoating. Because acrylics form a plastic film, they won't feather when sanded.

Latex can also create problems when used over rough cedar siding or redwood — applications where oil-based stain has always reigned supreme — due to the water-soluble extractives in these woods. Although extractive bleeding is usually a symptom of bulk moisture forcing its way out from behind the siding, the water in a latex stain can dissolve extractives, too, causing the stain to discolor as it dries. The latex film is porous, so it does not adequately block the extractives. Most professionals recommend a primer coat before applying opaque latex stains. And if you're putting an opaque latex stain over cedar or redwood, use a special stain-blocking primer first, especially for light colors.

Staying Within Limits

Regardless of which stain you choose — oil or latex — it isn't recommended by most professional painters on horizontal surfaces like exterior steps, decks, and railings (see Figure 3). Horizontal surfaces should be treated with a paintable water-repellent preservative first. Then use a primer and two coats of an oil-based or latex enamel deck paint. Stain just can't withstand the traffic, the moisture, or the direct ultraviolet light that routinely assaults such surfaces. And because a stain is less likely to peel than a paint, it may not warn you about potential moisture damage the way a paint will. The cottage that I worked on had a lot of rotted 2x6 deck boards, but my clients didn't notice them until somebody put their foot through one. Water had been seeping into the wood for years, but the stain showed none of the peeling that a paint would have.

You should also think twice before staining exterior doors, windows, and other expensive millwork. Stained doors, in particular, will absorb more moisture than painted doors and have a greater tendency to swell and rot.

In other words, don't expect more from a stain than it's designed for. A stain won't do anything a paint won't do, and on smooth surfaces it won't last as long as a good paint job. Regardless of the surface, however, it might appeal more to your client's taste. In this case, be sure to advise your client of the tradeoffs. ■

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