

# Finishes for Wood Decks

Environmental regulations and homeowner preferences are driving product innovation

by Chris Ermides



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Weather wreaks havoc on unprotected wood, even pressure-treated pine, tropical hardwoods, cedar, redwood, and others that are resistant to rot and insect damage. Moisture, whether from rain, snow, or humidity, causes problems like raised grain, cupping, and splitting. What's more, UV radiation from the sun breaks down the lignin that holds the wood's cellulose fibers together. This causes the wood's natural color to

gray — which doesn't impact longevity but isn't always the desired look.

Referred to variously as sealers, coatings, protectors, and stains, finishes penetrate the wood's surface to slow down its ability to absorb moisture, prolonging the life of the decking and maintaining its appearance. The choices are many. Solid stains, with distinct, grain-hiding colors, look more like a layer of paint; they offer the ulti-

mate protection (**Figure 1**). Clear sealers limit the wood's ability to absorb moisture, and they allow the wood to gray naturally from sunlight. Toners and semi-transparent stains also protect wood against moisture while offering some protection against the sun's rays (**Figure 2**).

What makes choosing among them more complex is that they are all available in water-based, oil, and oil-modified versions. Most manufacturers offer water- and solvent-based lines, typically for around the same price. Oil-based finishes penetrate better than the water-based finishes, whereas water-based versions offer more coverage than oil-based lines — because they don't penetrate as much — and clean up with soap and water. Oil-modified products — finishes that penetrate like a traditional oil product but clean up with soap and water — offer the best of both.

No matter what product you use, refinishing will be necessary every one to three years, depending on the exposure to sun and the elements.

## Sun Damage

In a study conducted by the Forest Products Laboratory in Madison, Wisc., now-retired scientist Sam Williams documented the effects of sunlight on wood. His research showed that the longer unprotected wood sat in the sun, the more damage UV radiation did to the lignin, in a process called photochemical degradation. When lignin is damaged, it can no longer bind wood fibers, which are then released from the wood surface. As the fibers loosen and detach, any colored pigments — like semi-transparent and solid stains — that are clinging to them also fall away. The result is a failed finish and an unhappy customer.

Williams found that the key factor in getting the most longevity out of any surface finish — whether stain or paint — is to seal the wood



**Figure 1.** While traditional water-repelling clear finishes allow wood to gray from the sun, colored products block UV-rays for further protection. Toners, like the red shown here, and semi-transparent stains allow grain to show through. Solid stains, like the white and the blue, hide the grain and provide the most protection from UV rays.



**Figure 2.** Toners and semi-transparent and solid stains are available from most manufacturers in a wide range of colors. Every wood species takes pigments differently, and while color charts can provide some guidance, don't rely on them. Doing your own color tests on sample boards is the most reliable approach. Toners allow the most grain to show while semi-transparent stains allow less.

before the sun ever hits the surface. The pigments protect the lignins, and thereby help prevent fibers from being released from the wood. In Williams' study, wood that had been painted before being exposed to UV maintained its integrity for well over 20 years.

Realistically, the wood you use may have already been exposed to UV radiation. Some stain manufacturers even recommend letting the wood weather before staining, to improve stain absorption, but this comes at the expense of surface damage. In these cases, sanding the wood prior to finishing it will release damaged lignin and loose wood fibers and provide a better base for finishes to cling to, making them last longer.

Lignin damage is also what causes wood to gray, an issue for homeowners who want to preserve the original color of the wood on their deck.

Exotic hardwoods like ipe, as well as domestic woods like cedar, are seeing increased use — for good reason. They're naturally resistant to termites, rot, and decay. And, let's face it, they are beautiful to look at. Many homeowners like the rich, furniture-like look and feel of hardwood decking, and want it to always look as it does the day it is installed (**Figure 3**).

Now that manufacturers of pressure-treated wood are offering boards with less of a green tint, some homeowners are wanting to preserve the nat-

ural look of pressure-treated wood. Huck DeVenizio, manager of marketing communications at Arch Wood Protection ([wolmanizedwood.com](http://wolmanizedwood.com)), which manufactures Womanzied products, says that newer treatment formulations sometimes even confuse consumers. "They think that the less green a pressure-treated product is, the less protection it has," he says. "But it's impossible to tell just by looking at the color."

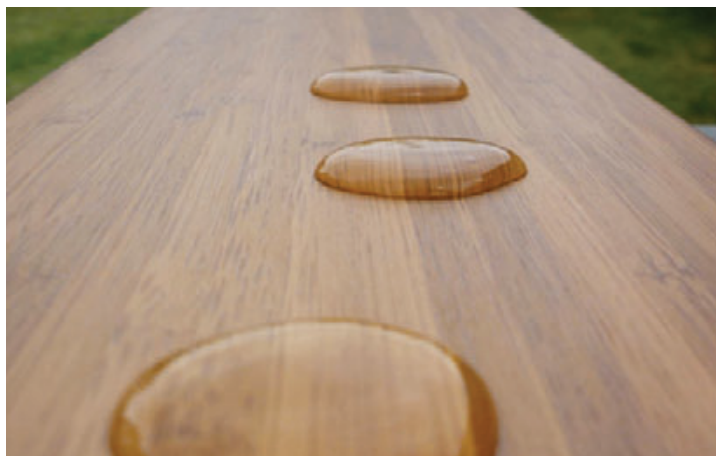
The problem with maintaining the original color on either hardwoods or pressure-treated woods is that no existing clear deck finish can protect wood from UV damage and the resulting change in color to gray. So for now, that leaves the options of staining the wood, or applying a clear finish and letting the wood gray.

### Not High School Chemistry

Made with acrylic-based resins, today's water-based finishes have gained a respectable place in the finishing market. Much of the impetus for their development might be the Environmental Protection Agency's ever-tightening VOC guidelines. Aimed at limiting the VOCs that solvent-based products can emit into the air, these regulations are pushing manufacturers to provide alternatives that have the desirable characteristics once found only in oil-based options; that is, to create penetrating and durable water-based finishes that won't peel.

Advocates of oil-based sealers like them for the way they wear over time. Because they penetrate the wood, they tend to fade rather than peel or chip, as older water-based products used to. But water-based products have changed. At one time, the main criticism of water-based products was that they were film-forming and weren't readily absorbed into the wood. These days, manufacturers point out that their water-based products do in fact make their way deeply into the wood. And this is, for the most part, thanks to nanoparticles (**Figure 4, page 4**).

Water-based products also tend to dry faster than oil-based products, which some deck finishers like, for obvious reasons. And because water-based products clean up with soap and water rather than paint thinner, they are sometimes marketed as a greener product. No solvents means lower VOC emissions and fewer toxic



CUTEK

**Figure 3. Protecting wood from the effects of moisture is the ultimate goal of a finish. A clear sealer will slow down or in some cases prevent water migration into the grain. A clear sealer shown here on bamboo, which is incredibly dense, illustrates how some products can perform.**



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chemicals to dispose of — better for our lungs and our environment.

Tim Leahy, a finishing foreman with Kirby Perkins Construction in Newport, R.I., is a big fan of water-based finishes. “Our clients are way more concerned with the longevity and durability of the finishes we use. There was a time when oil-based

products were far superior in that regard. But it’s just not the case anymore,” he says. Leahy also likes the lower VOC content and ease of cleanup.

There is middle ground between traditional oil finishes and water-based products. According to the manufacturers of the so-called oil-modified formulations, their coverage is similar to that of traditional water-based products, while at the same time they are easily absorbed into the wood. Perhaps most important from the user’s point of view, they clean up with soap and water like a water-based finish.

### Oil-Based Finishes Haven’t Gone Away

Most manufacturers of pure solvent-based finishes say they plan to keep producing them as long as they can (**Figure 5**). However, VOC regulations are becoming more and more stringent, particularly in densely populated areas. Because manufacturers have to adhere to these regulations, the products that you are able to buy in your area will comply. Laws also limit how manufacturers make their products available. Even if you buy online, you may not be able to get the product you want if it doesn’t comply with your state’s regulations.

Manufacturers are responding to environmental regulations and the market’s demand for greener products by developing low-VOC finishes. If the phrase low-VOC is on the container, it generally means that the finish emits fewer volatile compounds into the air than is allowed by the EPA. While some finishers, like Leahy, find that clients are much more concerned about durability than VOCs, manufacturers are still working to get low-VOC finishes on the market, for a variety of reasons — staying ahead of regulations, gaining a marketing edge, countering the rising cost of petroleum, and being honestly concerned for the environment.

Lowering the VOC content in solvent-based coatings is a tricky process. The resins and the solvents in traditional oil coatings are petroleum-based. These solvents are the main component that off-gasses VOCs. Reducing or even eliminating VOCs means reducing the amount of petroleum used or eliminating it altogether and replacing it with something else. In many cases,



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**Figure 4.** Thanks to nanotechnology, film-forming finishes are all but a thing of the past. Tiny particles are allowing pigments, which in older formulas sat on the wood’s surface, to penetrate more deeply into the wood. The result is a tinted finish that manufacturers claim won’t fade, chalk, or peel. Penetrating finishes seep into the wood, repelling water or slowing its absorption.



PENOFIN

**Figure 5.** Oil-based finishes are likely to remain on the market for some time, although new VOC regulations may limit where they can be sold.

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as with Penofin's Verde system, petroleum is replaced with a vegetable ester solvent and other plant-based resins.

Some in the industry contend that straight solvent-based finishes will become less common as the EPA continues to tighten VOC regulations. But don't panic. Manufacturers are spending a lot of time and money developing modified-oil- and latex-based products that penetrate and wear like oil-based finishes.

### Match the Product With the Substrate

Before you choose a finish, it's important to understand the properties of the substrate you plan to coat. Woods like ipe that are naturally resistant to bugs and rot don't typically come treated with a wood preservative. Some manufacturers, like Thompson's, discourage the use of certain products on ipe and other hardwoods like it, because the finishes aren't formulated to penetrate such dense wood.

### Tips on Finishing

**W**hether you're refinishing boards that have already been coated or starting from scratch, a clean, open-pored surface is the key to getting the most protection and life out of any finish. Best practices include using kiln-dried wood and coating every exposed sur-



**Start with a sprayer.** Most deck professionals agree that applying finishes with a sprayer is best. It provides ultimate control and allows for an even coat. It also puts finishes in difficult-to-reach areas. But don't stop there. Back brush the spray, or better yet, use a sponge-pad applicator to push stain deeper into the wood.

face of the board. Sealing all parts of the board reduces the potential for cupping, especially on surfaces where snow and water will sit for long periods of time.

Use a mild detergent to clean wood that has already been sealed. Deck cleaners offered by finish companies are formulated to be gentle on the wood's lignin, which bleach and water will damage. Remove any existing stain with a stripper. Depending on the level of grayness, brightener may restore the wood's original color. Lightly sand to remove mill glaze from new wood and UV-damaged fibers from old wood.

Apply finish to clean, dry wood that's free of dirt, mildew, and debris. Follow the manufacturer's recommendations for surface and air temperature.

Be sure that the product you're using is appropriate for the substrate. Hardwoods often require a penetrating finish.

When sealing new pressure-treated wood, follow the wood preserver's guidelines. Some pressure-treated wood contains water repellent and may need exposure to the elements before it will take a finish.

Most finishes can be applied by brush, pad, or sprayer. Professional finishers often spray and then either back brush or use a sponge pad. Spraying provides even coverage, and back-brushing works the finish into the grain. Sponge-pad applicators push the product even deeper into the wood.

Follow the manufacturer's instructions carefully. Some products are explicitly formulated to be applied only as a single coat, others require two coats. Applying more coats than recommended will create a film that is likely to peel. Also follow the product guidelines for drying time between coats; a second coat applied too soon won't penetrate evenly and may not dry at all.

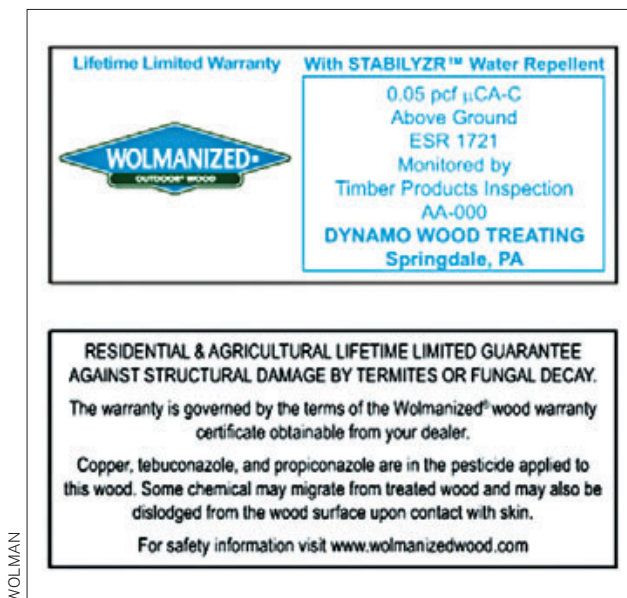
Sealing pressure-treated decking is another matter entirely. According to Arch Chemical's DeVenzio, some pressure-treated decking has a wax already built into it (**Figure 6**). Deck material of this sort isn't going to take a penetrating finish or stain very well, no matter how good the finish is. In some cases, this information might be on the decking label. It's a good idea to check the pressure-treatment company's website for finishing guidelines — on what types of finishes to use as well as when to apply coatings.

Experts agree that you'll get the best results on kiln-dried products. The moisture content in kiln-dried wood is the same across each board, so it's more stable than air-dried or wet wood. Because of that, kiln-dried wood reacts to weather conditions in a more consistent manner, and takes finishes more evenly. That's one of the reasons John Paulin, owner of Tailor Decks in Atlanta, uses kiln-dried lumber exclusively (he also appreciates the stability of the product from a building perspective). He has found that when finishes take to the wood more evenly, they wear more evenly as well. When kiln-dried wood isn't

an option and you use air-dried or wet lumber, sealing all sides of the board is a recommended best-practice.

Softer woods, like pressure-treated pine and cedar, absorb finishes more easily than exotics such as ipe, which are a whole other story. The very things that make hardwoods so appealing to homeowners and deck professionals present challenges when it comes to finishing them. Hardwoods are denser, for one, which on the plus side makes them less prone to absorbing moisture and less likely to get surface scratches or dings from lawn furniture and beer cans. But that density also makes it harder for manufacturers of stains and wood coatings to create products that penetrate the surface rather than forming a film over it.

Wood chemistry is different for all species, which makes formulating a stain even more challenging. Manufacturers who have wood chemists on their product-development staffs understand the nuances between different species and are more likely to tune their products to match the properties of particular woods. When a manufacturer touts a line specifically designed for ipe or mahogany, for instance, it's probably worth taking a closer look (**Figure 7, page 48**).



**Figure 6.** While all pressure-treated wood should be sealed for protection against the effects of moisture, recommendations for timing vary with the product. Wolman, for example, says that its Stabilizr product contains a water repellent and doesn't need to be coated the first year but should be sealed a year or two later.

### Fear of Film-Forming Finishes

Because they tended to be more difficult to refinish, film-forming finishes used to scare people. That isn't necessarily the case these days. A big difference between straight oil finishes and modified-oil (or alkyds) and latex finishes is that oil finishes don't form a film on the surface. They penetrate deeply into the wood, protecting it from the inside out. Film-forming finishes, like paint, create a shell or protective coating. Refinishing a deck with a non-film finish is usually a matter of cleaning, doing minor repairs, and then recoating. A film finish may require removing the old finish or other extensive work before refinishing.

Leahy cautions people to not over-apply finishes, particularly semi-transparent or solid stains. A misconception exists that exterior deck stains act like interior stains — but they don't. While both types of stains penetrate the wood, the similarity stops there. Adding extra coats to achieve a darker color is a bad idea with deck stains because they can form a film-like coat



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over the surface of the board. His advice: Read the label carefully and follow the manufacturer's guidelines. Some explicitly limit the number of coats you should use, and offer guidance on when to recoat.

Layering multiple coats of a finish can have a disastrous effect. Depending upon the product, even two coats of a solid stain can quickly become an oil-based paint. While that might not seem like such a bad thing, consider that stains aren't for-

mulated to act like paint. The pigments in the stain won't stick to each other as they do in paints, causing the stain to fail. Generally, after too many coats the finish isn't absorbed evenly, and the layers start to peel. The surface will look blotchy and in some cases shiny.

### Where the Industry Is Headed

Straight oil-based products may become less available in some areas because of environmental regulations, but manufacturers will continue developing alternatives with comparable qualities.

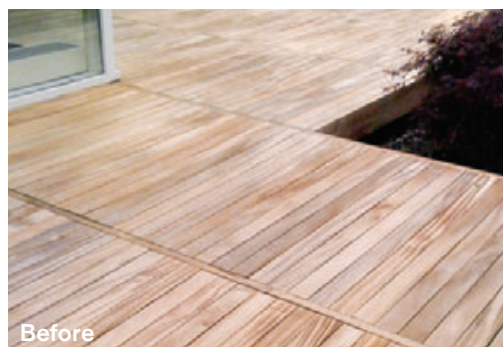
When it comes to finishing exotic hardwoods, the most sought-after product still does not exist: a clear finish that both protects against moisture and keeps UV rays from damaging the lignin and turning wood gray. Creating that product is what chemists like Mandla A. Tshabalala, a research scientist at the Forest Products Laboratory, are focused on. Tshabalala is studying nanotechnology as it relates to wood coatings. His primary objective is understanding how nanostructures can be incorporated into a clear coating to block UV rays enough to prohibit the UV degradation that causes graying.

Nanoparticle systems that preserve the substrate's color already exist for coatings on metals and plastics. But developing a system that works on wood is the ultimate challenge, says Tshabalala: "Not only are we dealing with a complex substrate, but it will vary even more for different wood species."

Nanotechnology is being used in many coatings on the market today, most readily in colored products that once left a film. It has already improved the durability and longevity of tinted products like toners and stains. Nanoparticles allow tinted, semi-transparent, and solid stains to provide uniform color and UV protection without the film.

Products on the market today are more finely tuned for specific uses than they've ever been, so don't use the same product for every job. Pick a product intended for your particular use, and follow the instructions. And prepare your customer that in two to three years, it will be time to do it again. ❖

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**Figure 7.** Left unstained, this ipe deck grayed as a natural result of UV exposure (top). Known as photochemical degradation, it's unavoidable unless you use a color-enhanced finish, like toner or stain. A deck brightener was used to remove most of the gray and even out the wood's tone, then a semi-transparent stain brought life back to the wood with a rich color, adding protection from the sun's UV rays (bottom).