

Cooked, Pickled, and Glass-Infused Decking

Three technologies produce nontoxic wood that bugs won't eat



ACCOYA

When it comes to wood decking, the most common options in the U.S. are pressure-treated wood and naturally rot-resistant species like tropical hardwoods, cedar, and redwood. In recent years, however, a few other choices have been introduced and are slowly gaining ground. One of these is thermally-modified wood, now available from several suppliers in the U.S. Another is acetylated wood, and though it's currently available from only one source (and that's in Europe), there's a real possibility that

it will be produced domestically in the next year or so. The third is wood that's infused with sodium metasilicate — essentially glass. It's made by a single manufacturer in the U.S., but distribution has been growing.

Unlike pressure treatment, which adds chemicals to wood to make it decay resistant, the thermal modification and acetylation processes alter the chemical and structural properties of wood without adding chemicals that aren't already present. Neither process depends on chemical penetration — sometimes a concern with larger-dimension pressure-treated timbers.

Cooked Wood

Thermally modified wood first gained a foothold in Europe, where the technology of heating wood to bake away sugars

by Jefferson Kolle

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that micro-organisms feed on has been used commercially for a number of years (Figure 1). In the U.S., the products have met with lukewarm acceptance, in part due to an uncertain outlook for the building industry, limited distribution, and contractor reluctance to try new products, particularly ones offered by smaller manufacturers.

Several manufacturers have set up kilns in the U.S. to thermally modify wood based on European technologies, but the big investment required has been a deterrent to some other potential adopters (Figure 2). Tom Murray, sales manager at Rex Lumber, says his company looked long and hard at setting up a thermal-wood kiln. However, the Northeast lumber dealer is waiting to see what the market will do.



ECOVANTAGE

Figure 1. Thermally modified wood takes on a dark color along with its decay-resistant qualities.

“We weren’t totally sold on the technology of heat-treating wood,” he says, “especially since our decking sales have been disappointing the last few years.”

Two Contractors, Two Views

In Oklahoma City, John Hyatt’s company, Deckmasters, installs a lot of tropical hardwood decking, and he wanted to like thermally modified decking. He admits that his unscientific testing — leaving 6-inch-long pieces of the decking out in the weather for several months — might not have given it the fairest shake. Still, similar samples of cumaru didn’t move as much or get as many surface checks as the thermally treated wood. “It’s an unproven product,” he says, “and I just can’t see using one of my customers as a guinea pig.”

Tracey Dean, a contractor in South Padre Island, Texas, has a different take on the product: He’s sold. Here’s why. After 20 years, the CCA decking on the more than 20,000 square feet of ocean-front decking at the Boardwalk condominiums had worn out. “We replaced the CCA with the new type of non-CCA pressure treated,” Dean says, “and then it only lasted another six years before it was all twisted and split. Some of it had moved so much that it pulled big chunks of concrete out of the foundations.” The condo’s homeowners association decided against composite decking because of its appearance and looked to Dean for suggestions. “I studied all the products and was convinced that thermally treated wood was the way to go.”

The homeowners association liked the toasted-brown color of the wood and the fact that it’s chemical free. Dean liked the 30-year warranty given by the manufacturer, EcoVantage (260/337-0338, ecovantagewood.com), located in St. Joe, Ind. “I told the homeowners association that we could replace the pressure-treated decking every six years or spend twice as much and get 30 years out of the heat-treated wood.” Based on Dean’s recommendation, the board established a new rule that only thermally modified decking could be used for the condo’s decks.

Dean is replacing some of the worn-out framing with thermal wood, along with the decking. “The stuff is hard,” he says. “You definitely have to predrill everything.” As recommended by the manufacturer, he coated all the decking with an oil-based penetrating stain with UV protection to prevent the brown color from weathering to silver. So far, the thermally treated wood has been in place for a year and a half. “It looks just like the day we put it down,” Dean says.

The Heat-Treating Process

Thermally treating wood involves heating the wood in a kiln that’s evacuated of oxygen. The initial temperature is similar to traditional kiln drying and removes most of the water,



BAY TREE TECHNOLOGIES

Figure 2. The cost of setting up manufacturing plants is a barrier to entry for new modified-wood producers.

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then the heat is cranked up to around 500°F. (If there were oxygen in the kiln, the wood would ignite.) At that temperature, chemical and structural changes occur in the wood that make it more dimensionally stable, and insect and fungus resistant. These changes include degradation of the hemicelluloses, which are essentially sugars; modification of the lignins, which glue the wood fibers together; and evaporation of extractives such as tannins. Next, steam is introduced into the kiln to restore moisture to the wood. Depending on the manufacturer, the resultant product has a moisture content between 4 percent and 8 percent.

How long and at what temperature to cook wood is determined by its species and the boards' thickness. Ron Long is the president of Bay Tree Technologies, maker of PureWood (Bay Tree Technologies, USA; 816/581-6190, purewoodproducts.com). Over a time period of up to 52 hours, Bay Tree's three kilns can each process 40,000 board feet of southern yellow pine or Douglas fir in several different decking profiles, including tongue-and-groove porch flooring. "It's like a cake," Long says. "You'd bake a thicker one for more time than you would a thinner one." Bay Tree uses a small, .5-cubic-meter kiln for testing new species and thicknesses before thermally treating a full load in the big kilns.

While thermally treated decking doesn't require any finish to maintain its decay resistance, a coating of a UV-blocking sealant is recommended to prevent the wood from turning gray. Bay Tree puts a coat of 100-percent-acrylic UV-blocking stain on its product in its factory (not all manufacturers do

this) to retain the toasted-wood color and also recommends that contractors apply another one or two coats when the deck is finished. "And we recommend coating end cuts during installation," Long adds.

Cooking Wood Has a Price

The intense heat of the kiln is hard on the wood, which moves a lot during the thermal process. Afterward, it's much more stable. Bay Tree stickers the wood before heating and places thick steel plates on top of the lifts of lumber to control movement (**Figure 3**). After the wood comes out of the kilns, it goes through a molder and shaper that removes residual wood sugars from the surface and reduces the wood to its finished dimension.

Long says the steel plates, the milling process, and the right amount of steam at just the right time are all part of the company's quality-control system. "We have less than a 2 percent fallout [an industry term that refers to wood not suitable to make into finished product]." He adds, "We have a couple of different points where we inspect the wood: The first quality check is during the initial stickering of the load prior to entering the kiln, next we see it when we de-stick it prior to molding it, and the final look is after it comes out of the staining line." Bay Tree's decking comes with a transferable 25-year guarantee.

EcoVantage heat-treats southern yellow pine for decking, as well as for framing lumber, railing components, and pergola parts. Kate Gigli is the marketing manager for the company, and she says it uses only #1&Btr grade wood. "Our quality control requires that our product have no knots bigger than a pea," she says. "Our fallout is around 20 percent."

But Is It Green?

Manufacturers of thermally treated decking appeal to the green-building crowd by emphasizing that their products contain no added chemicals, unlike pressure-treated decking. But some detractors are quick to point to the huge amount of energy that's used to cook the wood. "It's a fact that we use oil-fired furnaces in the initial heating process," admits Long. "But in the next year or so our kilns will use 80 percent renewable energy." He explains that shavings from the milling process and gases released from the wood will be burned to make heat. "All that will come out of our kilns is steam."

Scientific testing of thermally treated wood backs up manufacturers' claims about the wood's stability, its inability to absorb water, and its resistance to biological attack. Roger Rowell, professor emeritus at the University of Wisconsin, has studied thermally modified (as well as acetylated) wood for the USDA Forest Products Laboratory. He says that when



Figure 3. To minimize wood movement in the kiln, Bay Tree Technologies stickers and weights the lumber.

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wood is subjected to high temperatures, “most of the hemicelluloses are removed and that is the reason there is dimensional stability and biological resistance.” (Hemicellulose is a polysaccharide; removing it takes away food that rot organisms eat.) What manufacturers don’t usually point out is that the heating process also reduces the wood’s strength by making it brittle and unbendable — think about what happens to bread when you toast it. Heating also increases the wood’s brashness, the characteristic that causes a piece of wood to break abruptly across the grain.

Rowell says that manufacturers “want you to believe that there is no strength loss, but there is ... a lot.” He tempers that by pointing out that “decking does not need much strength, but the brashness and brittleness is a concern to me long term. Sand and walking are going to sand paper the surface.”



Figure 4. Acetylated wood has had a European market for several years.



Figure 5. TimberSil preserves and stabilizes wood by infusing it with “liquid glass.”

Pickled Wood

Acetylation is another process that increases wood’s stability and insect and fungal resistance without the addition of any harmful chemicals. But unlike thermally modified decking, acetylated wood loses none of its strength as a result of its treatment.

John Alexander is a chemist and the head of product development at Accsys Technologies (accoya.com), a British company that is currently the only source of acetylated wood in the U.S. (under the brand name Accoya). He explains that wood naturally contains acetyl groups — 2 percent in pine and 5 percent in oak — which are hydrophobic, meaning that they repel or won’t mix with water. Wood also contains hydroxyl groups, and Alexander says they “bond very readily to water, and this bonding causes the onset of decay, wood swelling, and shrinkage [when the moisture evaporates].”

The acetylation process increases the amount of natural acetyl compounds in wood by an approximate factor of 10. It does this by reacting the wood with acetic acid to convert hydroxyl groups to acetyl groups. (Vinegar is diluted acetic acid, which is why some people refer to acetylated wood as being pickled.) The result is completely nontoxic wood that cannot absorb moisture and therefore is 80 percent more stable and resistant to biological attack, according to the manufacturer.

Tests Suggest Long-Term Durability

In some treated woods the added chemicals can leach out in the presence of water, but Professor Rowell’s tests show that moisture has no effect on the presence of acetyl compounds. In the *Forest Products Journal*, he wrote, “This experiment has been ongoing for more than 20 years; results continue to show little or no loss of acetyl from humidity cycling.”

Accoya wood is guaranteed for 50 years in exterior use and 25 years when used in the ground (**Figure 4**). Impressive. It’s made from sustainable Radiata pine — another plus from a green perspective. However, it’s grown in New Zealand and shipped to the Netherlands for treatment; from there it’s shipped to the U.S. for sale as rough lumber. Thus the wood travels farther and requires more energy to transport than South American hardwoods.

Kimberly Lancaster-Hageman didn’t object to that, though, when she was choosing decking for her ocean-front house in Rhode Island (see photo on page 46). Her location is subject to periods of horizontal, wind-driven rain and brutal sun. “I researched it to death,” she says, “and I knew I wanted decking that wasn’t a food source for insects and mold.” She considered composite decking but decided she wanted wood that would turn silvery grey. “The Accoya cost a little more than [composite lumber] and a little less than ipe.” Her decks were

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installed in early 2009, with TigerClaw invisible fasteners. “The decks have performed fabulously,” she says. “No splitting, no splintering.”

Acetylated wood is currently available from only five distributors in the U.S., although Accsys Technologies says it plans to increase distributorship, and earlier this year it announced it was increasing wood production by 50 percent.

Glassy Wood

TimberSil (TimberSil Products; 864/277-7007, timbersilwood.com) is an American product that’s been available for about six years (Figure 5, page 4). Wood is infused with a solution of sodium metasilicate, so-called liquid glass, in a pressure tank, then baked in a kiln. The result is that the wood fibers are wrapped with amorphous glass that protects them from decay organisms and improves both the wood’s stability and its strength, says the manufacturer. Also according to the manufacturer, TimberSil is the first product recognized by the U.S. EPA “as a non-toxic barrier product for its ability to exclude pests only by providing a physical barrier, while containing no toxicants.” It also claims a Class A fire rating, making it code-approved for use in the Urban Wildland Interface, even in California, whose wildfire building codes are some of the strictest in the country (Figure 6).

Mike Guertin, a builder in Rhode Island, used TimberSil on a trial deck. Says Guertin, “I used the TimberSil on one of my rental homes, so I see it regularly. It has gone through a few phases over the last three or four years since I put it in. First was the mold phase — not sure what that was all about, but it developed gray/black mold spots all over. I did nothing and they went away. Last year was the fur phase. I read about this from some other users. The top layer of fibers seems to slough off, and it looks like fur for a while before the fibers wear off. Now it seems to be settling in. Not as much splitting as regular pressure-treated lumber but small surface cracks like you get with SYP. The wood doesn’t seem to get soggy like PT after extended rain periods. I’ve never metered the boards (moisture content), but it doesn’t seem to suck up water much.” Rick Dixon, vice president of technology for TimberSil, acknowledged that there had been a problem with “incomplete polymerization in some lumber” that would have resulted in the furring problems Guertin encountered, but added that the issue has been resolved.

In general, the economy hasn’t been kind to new building products, particularly any sort of lumber that is typically sold through “two-step distribution.” In two-step distribution, the manufacturer supplies wholesale distributors, which in



Figure 6. With a Class A fire rating, TimberSil (foreground) is accepted for decks within the Urban Wildland Interface.

turn sell to lumberyards. With the current down building economy, few distributors or lumberyards are investing their limited capital in products whose sales are unproven. In part because of this structure, TimberSil has had difficulty finding distribution channels. In answer to that, Dixon said that TimberSil has initiated a one-step distribution process that’s seen success in California. He also said that TimberSil was readily available in southern New England through traditional two-step distribution.

What’s Next

As the economy quickens and thermally modified, acetylated, and glass-infused wood become more widely accepted, it’s likely that availability will increase. EcoVantage is about to open a large distributorship in the Northeast, according to marketing manager Gigli, and soon the company will start producing thermally modified oak for exterior use. TimberSil plans to initiate a one-step distribution process in Texas beginning early in 2012. And there’s hope for acetylated-wood production in the U.S., too. Eastman Chemical Co., in Kingsport, Tenn., has plans to start producing pickled wood. A spokesperson for the company says, “We could be ready to go in a year. But we’ve been saying that for more than a year.” Time will tell. ❖

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