Synthetic Decking

by Scott Gibson

Wood substitutes cost more but promise less maintenance

Dozens of manufacturers together churn out millions of board feet of wood-plastic composites a year. In addition, a growing number make all-plastic decking — and for something completely different, there's powder-coated aluminum (**see "An Aluminum Alternative," page 3**).

With so many options, there's bound to be some trial and error when selecting and learning to work with a new material. One source of help is decking manufacturers, many of which provide detailed installation instructions on their Web sites (**Figure 1, page 2**). A basic understanding of how the materials are manufactured can also help deck builders choose the right products.

Composite Soup

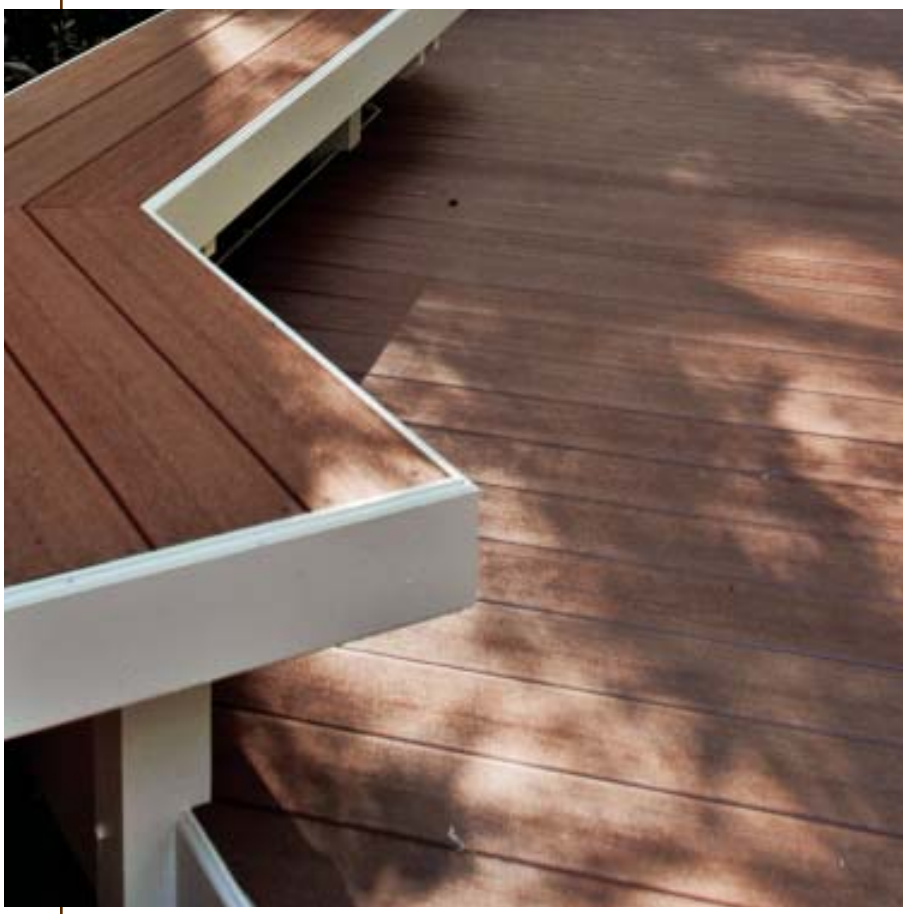
Wood-plastic composites are made from one of several polymers — polyethylene, polyvinyl chloride, and polypropylene are the three most common — plus finely ground wood flour and a variety of additives that stabilize the plastic and protect it from UV damage.

This medley of materials gives composites several advantages over most species of wood: Installed correctly, they're much less likely to check or crack, and there's no evidence that termites will attack it. Also, it doesn't have to be stained or treated with a preservative — that alone is enough to gather in homeowners weary of trying to keep wood decking looking new.

Composite decking isn't bulletproof, however. The wood component can make these boards susceptible to mold, mildew, and under the right conditions, decay. And it still needs regular cleaning. "It's not a no-maintenance product but it's definitely low-maintenance," says Nicole Stark, a research chemical engineer at the Forest Products Laboratory in Madison, Wis.

How a particular brand of composite decking performs depends on a variety of factors, including what it's made of — the type of plastic, the kinds of additives and stabilizers, and the proportion of wood flour to plastic in the mix — and how it's manufactured and installed. And here's the rub: Each manufacturer has its own secret recipe and method of production.

Plastic ingredients. As much as three-quarters of all wood-plastic composite decking is made with polyethylene (recycled or virgin), a soft plastic that's used for plastic bags and



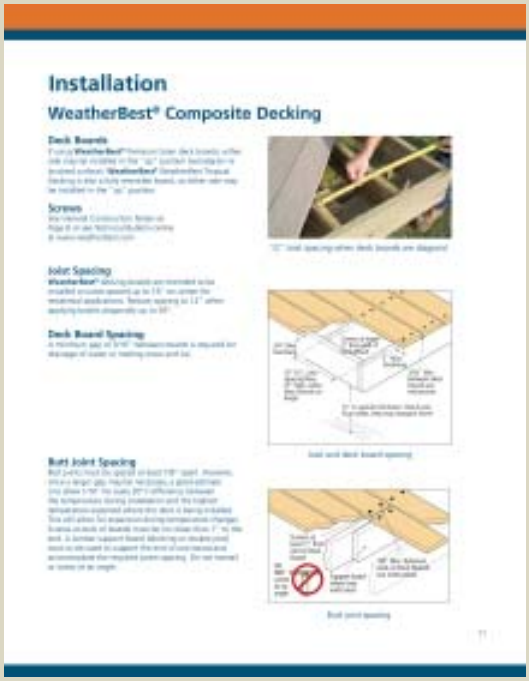


Figure 1. For the most part, composites can be screwed down just like wood. However, tighter joist spacing may be required, special screws are available, and you generally need to consider the material's movement along its length, not its width. Most manufacturers have installation guidelines on their Web sites.

a variety of other products. A smaller number of manufacturers use polypropylene, which is a much harder plastic, or polyvinyl chloride (PVC).

Some manufacturers use only recycled plastics in their decking, but this is not universally the case. Though having post-consumer plastic as an ingredient makes the decking more attractive from a green-building point of view, an obstacle is that recycled plastic may be a mixture of several types. As a consequence, its properties are less predictable than those of virgin plastics. Moreover, since some longwearing types of plastics — polypropylene, for instance — are tough to get as a recycled product, manufacturers may be forced to use a blend of virgin and recycled polymers.

While they're all in the plastics family, these polymers have different characteristics. The strongest and stiffest of the three is PVC, according to Stark, followed by polypropylene, high-density polyethylene, and then low-density polyethylene.

All other things being equal, a plank made from PVC or polypropylene will be noticeably stiffer than one produced with low-density polyethylene. Decking made from polypropylene can span up to 24 inches while a polyethylene-based deck board will span only 16 inches.

The plastics weather differently, too. Polypropylene, for example, is more susceptible to weathering and surface oxidation than polyethylene, says Stark. PVC, though also susceptible to weathering, is easier to stabilize than either polypropylene or polyethylene.

The bottom line? The type of plastic used to make the decking is important, but it's not the whole story.

Wood flour. The amount of wood flour added to the brew is another wild card. It can come from either hardwood or softwood species, although some manufacturers avoid woods high in tannins, such as oak, because of the higher risk of staining. From a structural standpoint, the species of wood used probably doesn't make much difference.

Because wood flour doesn't add any strength — in fact, it makes the plastic a little weaker — the industry calls decking composites "filled plastics." Wood flour does make the material stiffer, however. If that seems counterintuitive, think of steel cable: It's very strong but quite flexible. Or glass: It's very stiff but relatively weak.

Wood flour decreases "creep," the tendency for materials to deflect over time under a load, and lowers the coefficient of expansion, meaning a composite board shrinks and expands less with changes in temperature than an all-plastic one does. Wood flour also gives the product a more woodlike appearance and feel. In some decking, wood flour is the only recycled content, with no use of recycled plastic.

The "M-Words"

As many deck owners have discovered, wood-plastic composites can support the growth of mold and mildew — just like the wood they're designed to replace. That's part of the trade-off when using wood flour.

"Generally speaking, for fungal decay and attack by mold fungi, wood needs about 20 percent moisture content," says Stark. "Solid wood absorbs water pretty readily. In wood-plastic composites, depending on the surface or how they're manufactured or how much wood is in there, wood particles can themselves absorb moisture."

She suggests taking a close look for wood particles at the surface of the composite. The more readily apparent

they are, the more likely the board is to absorb water, thus increasing the risk of both mold growth and eventual decay (**Figure 2**).

Lower proportions of wood flour mean most of the particles will be encapsulated by plastic and safe from water. When the percentage of wood flour reaches 50 percent to 60 percent, some particles inevitably will touch each other, making water absorption more likely.

Some manufacturers might not disclose the ratio of wood flour to plastic in their decking; in those cases, the best bet may be Stark's eyeball test. A large number of prominent wood particles on the surface doesn't mean the decking should be avoided, but it is an indication that the planks will be more likely to absorb water.

How a board is manufactured may also affect water absorption. Planks extruded under higher pressure tend to have a more polymer-rich surface, says Stark, which provides some protection from water. "Moisture really is the key to improved durability," she says. "You have to control moisture in wood-plastic composites. Any way you can improve that, you'll have improved durability, not only with decay and mold but also with weathering and color."

Regular cleaning can reduce the risk of mold. Contaminated surfaces may be brought back to life with a commercial deck cleaner and brightener, and some composites may even benefit from a water sealer and preservative or stain. "People think it's no-maintenance," says Washington, D.C.-area deck builder Clemens Jellema, who regularly uses composites from three different manufacturers. "But I tell them there's no such thing as no maintenance. You still have to clean it."

KIM KATWIJK

Figure 2. Because composite decking contains wood, some brands may support mold growth. Depending on the proportion of wood flour to plastic resin and how the decking is manufactured, particles of mold-feeding wood may be exposed on the surface.

Fading

The other inherent problem with wood flour is it fades in sunlight. Ultraviolet radiation attacks the lignin in wood; therefore wood-plastic composites made with a high proportion of wood flour will fade and weather much like solid wood planks. A number of stains specifically formulated for wood-plastic composites are available, and more are under development.

To combat fading, some manufacturers are using a "co-extrusion" process: An inner layer of wood-plastic composite is capped with a layer of plastic that keeps moisture out and reduces the risk of stains. Correct Building Products' CorrectDeck CX line, which incorporates an anti-microbial agent called Microban in the top layer, is manufactured this way.

Martin Grohman, president of Correct Building Products, says the cap of polypropylene addresses three chief

AN ALUMINUM ALTERNATIVE

Manufacturers of most plastic decking and plastic-wood composites go to great lengths to make their products look just like wood. That's not the case with LockDry (FSI Home Products Division; www.lockdry.com, 800/711-1785), a powder-coated aluminum decking that looks just like, well, aluminum.

Like plastics and wood-plastic composites, LockDry doesn't have to be painted, stained, or waterproofed, and it won't splinter or crack. But unlike conventional deck planks, LockDry's interlocking pieces form a gapless surface the company guarantees to be waterproof. The company says that attribute makes it a good choice for decks built over living spaces, not only because the decking keeps water out but also because it's cheaper than installing sleepers and decking over a membrane roof.

Decking is available in four colors – none of them a wood tone – and in lengths of up to 40 feet. It costs about $7 per square foot. The company says installation is faster than it would be for wood or composite decking, and when lower labor costs are factored in the cost is competitive with the rest of the market.

LockDry says its decking stays cool under foot and can span 30 inches in residential construction (24 inches for commercial applications). It can be installed over wood, steel, or aluminum floor joists.

complaints consumers have about wood-plastic composites: color fade, mold and mildew growth, and the difficulty of removing stains. Adding a higher concentration of UV-blockers and anti-microbial agents to just the cap is more economical than adding them to the entire board. Even so, CX decking costs about 25 percent more than the company's standard line.

All-Plastic Decking

For a summary of the downsides of mixing wood flour with plastic, you'll have to go no further than David Cook of EPS Plastic Lumber, the maker of Bear Board. Cook, the vice president of sales and marketing for the company, calls wood the "Achilles heel" of composite decking, not only because its porosity allows in water but also because it just as easily soaks up grease, sap, and other staining materials.

Bear Board is made from high-density polyethylene gathered mostly from post-industrial recycling. According to Cook, the all-plastic formulation 5/4 planks are stiff enough for 16-inch on-center framing in residential applications (12 inches on-center in commercial work), with none of the water or stain absorption problems of wood-plastic composites and virtually no color fade.

All-plastic decking has its own downsides, however: Some has a shiny look that not everyone likes, and because there are no wood particles in the formulation, thermal expansion is a more pronounced problem. Cook says EPS's manufacturing process gives Bear Board more of a matte finish than some all-plastic planks, but there's not much he or anyone else can do about plastic's thermal properties.

A 10-foot board can expand and contract more than 1/2 inch in a 100-degree temperature swing. That means even with careful installation it's inevitable that there will be some gaps

KEEPING IT GREEN

Synthetic decking is unlikely to win any price wars – especially when compared with pressure-treated lumber – but it can be appealing to homeowners who want sustainable-building and eco-friendly products. After all, decking made from recycled materials has kept millions of tons of discarded plastic and waste wood out of municipal landfills, turning low-value refuse into a useful and valuable end product.

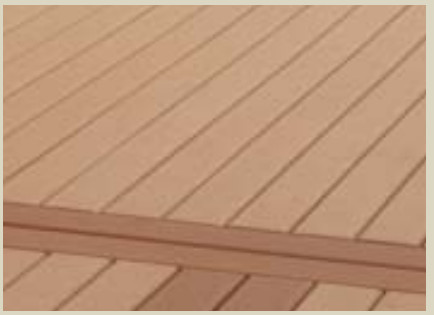
But be careful about overselling this feature. While some synthetic decking is made from all, or nearly all, recycled material, that's not universally true. Moreover, some plastics are inherently more difficult to recycle at the end of their service life or are more hazardous to produce in the first place.

FOTOLIA

The Healthy Building Network (www.healthybuilding.net) is one source of information on this potentially perplexing topic. In its *Guide to Plastic Lumber,* published in 2005, it rated the environmental merits of 55 brands of plastic lumber from 44 different manufacturers and ranked them in five broad categories, from "most environmentally preferable" to "not environmentally preferable – avoid." Highest preference was given to products with a minimum of 50 percent post-consumer content and those made solely with high- and low-density polyethylene, an easy-to-recycle plastic.

The organization considered both the production and the afterlife of products in its review. It recommended limiting the use of wood-plastic composites, for instance, because the mix of synthetic and biological materials makes them difficult to recycle, and it put products manufactured from a mixture of post-consumer plastics in the same category because they are likely to contain contaminants. PVC and polystyrene should be avoided altogether, it said, because of chemical hazards associated with their manufacture and disposal. A summary of all the findings and a product-by-product ranking is available on the Healthy Building Web site.

There is, of course, more than one way to rank products on an eco-friendly scale, and the benchmarks used by the Healthy Building Network may seem a little tough to some consumers, to say nothing of decking manufacturers whose products got panned. But the list and accompanying discussion can be a starting point for weighing the merits of a company's marketing claims.



BEAR BOARD

Figure 3. One way to deal with the greater expansion and contraction of all-plastic decking is to avoid long lengths. Adding planks perpendicular to the main run not only adds interest, it allows for expansion joints.

between plank ends, at least at certain times of the year. Because high-density polyethylene moves around so much, the company recommends using hidden fasteners and boards with grooved edges, rather than face-nailing or screwing, for lengths over 12 feet. Also, an intermediate crosspiece can be introduced on long runs to keep deck boards shorter (**Figure 3**).

There are a number of other all-plastic deck options, including PVC (Deck Lok from Royal Outdoor Products), polystyrene (Eon from CPI Plastics Group), and cellular PVC (Procell, made by Procell Decking Systems).

Like high-density polyethylene, these plastics are less prone to staining than most wood-plastic composites, but also like polyethylene, they are more prone to thermal expansion. And while some brands have an embossed surface that realistically mimics wood grain, others have an unnatural surface sheen that doesn't look much like the wood it's trying to imitate.

PVC carries with it an added environmental burden: its manufacture produces some dangerous by-products, and it releases dangerous toxins when burned. That may not affect its in-service performance, but homeowners with strong eco-sensibilities may prefer to stay away from it, nonetheless (**see "Keeping It Green," page 4**).

CORRECT BUILDING PRODUCTS

Figure 4. Depending on the product, composite decking may install more quickly than other options. Deck builders report that some hidden fastener systems, such as CorrectDeck's, actually speed installation, as well as provide a fastener-free look.

Higher Costs vs. Improved Performance

Wood-plastic composites lag far behind wood in terms of installed square footage but are quickly gaining ground. Between 1997 and 2004, according to a March 2006 article in *Forest Products Journal* ("Opportunities for Wood/Natural Fiber-Plastic Composites in Residential and Industrial Applications"), composites grew from 2 percent of the market to 15 percent while wood dropped from 96 percent to 79 percent. "Countering the long-held tenet that building products are purchased solely on price rather than performance benefits, WPCs have succeeded in the market with a substantially higher material cost compared to the competition," wrote authors Paul Smith and Michael Wolcott.

At the time that article was written, composites were running about twice the price of 5/4 ACQ-treated decking. Because both pressure-treated and composite decking require the same structural framing, however, the authors estimated that composite decking added only 15 percent to 20 percent in total cost when compared with a deck made entirely from pressure-treated wood. And because of lower maintenance requirements, the payback on composites for a homeowner could come in as little as two to five years.

Pressure-treated decks are priced at about $25 per square foot in the Washington, D.C., area, Jellema says. A composite deck with vinyl rail would cost between $40 and $45 a square foot, or between $32 and $34 a square foot without a railing. He says the cost of labor is roughly the same, although some composites with hidden fastening systems go down quickly, reducing labor costs (**Figure 4**).

If the upcharge to homeowners for using a composite is relatively small, it's not hard to sell — at least in an affluent market such as Jellema's. Composite and all-plastic decking together now comprise 40 percent to 50 percent of his jobs, and he expects that to grow to 60 percent to 65 percent in the future. Three-quarters of the way through 2007, Jellema had yet to install a single pressure-treated deck. ❖

Scott Gibson is a writer in East Waterboro, Maine, who specializes in construction topics.