

The Evolution of the Wood Panel

Engineered solutions minimize waste, and maximize performance, design and value.

By Kenn Busch



The demountable walls in this luxury laser boutique are thin thermally fused melamine (TFM) panels, chosen for their durability and design.

PHOTO: KENN BUSCH

In the beginning there was wood, and wood was the word—the last word, that is, in construction materials for furniture and interiors, and the primary resource for mankind’s first built environments.

For millennia, solid wood has been used for floors, walls, ceilings, and everything in between, including cabinetry, tables, seating, and worktops. It was abundant, easy to harvest and work with, durable, and beautiful; it was nature’s perfect building block.

Working with solid wood created a significant amount of waste, or offal, however, which either became fuel for the hearth or was hauled off as garbage.

As man’s demands for ever-more elaborate structural designs evolved, solid wood began to reach its engineering limits. Variances in its consistency and its inherent susceptibility to changes in temperature and humidity (leading to warping and splitting) created a demand for something more uniformly stable, and something that is available in large sizes and volumes.

Enter plywood. Plywood is created by harvesting whole trees and peeling the lumber into veneer, which is sliced into sheets, laid up and glued at 90-degree angles to create a panel. This cross-grain construction method counterbalances wood’s natural tendencies to expand in the direction of the grain, so plywood panels are far more dimensionally stable than even edge-glued solid lumber.

While plywood makes far more efficient use of wood fiber than working with solid lumber, there is still a lot of



Learning OBJECTIVES

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After reading this article, you should be able to:

- ▶ Describe the similarities and differences in the makeup of particleboard and MDF.
- ▶ Understand which engineered panel products are best-suited for different applications and environments.
- ▶ Discuss the environmental advantages of thermally fused melamine decorative components.
- ▶ Describe the differences between 3-D laminates, TFM and HPL surfaces.

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CONSISTENCY IN Commercial Projects

Johanne Courteau, director of the interior design department for Tremblay L'Écuyer Architects (TLA) of Montreal, says TFM is a bit of a secret weapon in her firm's arsenal.

TLA specializes in commercial projects, including schools, municipal buildings, medical clinics, grocery stores, industrial buildings, and restaurants, as well as high-end residential. The firm prides itself on using the latest in technology and materials in its projects, and using them in harmony with its clients' goals. The company recently used TFM in a boutique hotel for wall paneling and fireplace mantles in the lobby, and for

cabinets and fixtures in the guestrooms.

"In commercial projects, TFM is a stronger material than wood, [and is] easier to maintain and clean ... so we've never had any clients ask us why we don't use 'real wood,'" says Courteau. "TFM is also much cheaper, and the designs and colors are more consistent—both very important in commercial projects.

"We use it everywhere; for cabinets, worktops, banquets ... I've worked at other design firms and many still don't know what a great, durable decorative product TFM is. I'm surprised, but there are still many designers specifying materials that cost more and don't perform nearly as well."



In high-contact areas where wood and veneers are easily damaged, TFM is a more durable alternative that also delivers design consistency.

waste involved in its manufacture; waste that (still) must be landfilled or burned ... or preferably, used to create the next generation of wood-based panels.

MODERN ENGINEERED PANELS

Particleboard and MDF represent the highest level of evolution in maximizing the use of wood fiber left behind by other manufacturing processes from lumber mills, plywood plants and furniture fabrication. Particleboard, as the name implies, is made up of small wood particles or chips bound together by any of several different resin systems under heat and pressure. In MDF (medium-density fiberboard) the wood chips are further refined down to cellulosic fibers, producing a panel with a smoother surface and a more homogenous core than particleboard. By volume, these panels consist of mostly reclaimed wood fiber (more than 90 percent by volume).

Both are well suited for specific interior and furniture applications: particleboard, for applications that require a stable, economical substrate that will be surfaced with a decorative overlay (a veneer or laminate); and MDF, for components that will be finished with paint, lacquer or thinner decorative overlays that might "telegraph" the less-homogenous texture of a particleboard surface.

MDF is also the material to choose for designs that call for machining details into the core of the panel: e.g., radiused edges and rounded corners; channels or recesses in the interior of the panel for integrated door and drawer pulls; and, designs that mimic raised-panel and other door designs.

Special grades of particleboard and MDF are available for specific applications, including enhanced moisture and fire resistance, increased dimensional stability in extreme conditions, higher density, greater screw-holding properties, and lighter weight. The resin systems can also be engineered to meet and exceed indoor air quality regulations and consumer demand.

ADDING THE DECORATIVE SURFACE

Although some designs call for finishing raw particleboard and MDF with lacquers or a powder coat, the overwhelming majority of these substrates receive a decorative overlay or laminate.

The standard bearer in laminates is, of course, HPL (high-pressure laminate)—that wondrous jet-age material made famous by Formica and Wilsonart. Like engineered wood panels, HPL is mostly wood fiber—several layers of core, or "kraft" paper (similar to that used for brown paper bags), topped with a solid color or printed decorative layer and a protective wear layer. The lower-cost phenolic resins are dark in color, which accounts for that brown line you see at the edges of a sheet of HPL. Costlier melamine resins are clear and don't interfere with the aesthetic integrity of the décor layer.

When you laminate a substrate with HPL, you are basically joining two products that are manufactured, shipped, sold and stored separately in what amounts to a third process: gluing them together. The advantage to this is, it's convenient for small fabrication shops to use, and can even be done right on the job site. The disadvantage is, it's expensive in terms of materials costs and labor, and involves a larger number of processing and manufacturing steps than is necessary to satisfy the demands of many end-use applications. But, we're getting ahead of ourselves.

THE BIRTH OF TFM

More than a quarter century ago, European panel manufacturers began bonding the decorative paper layer directly to the panel faces, producing a laminated panel with fewer manufacturing steps. Under heat and pressure the resins in the decorative layer actually crosslink to those in the board, creating a homogenous decorative panel, without need for an adhesive.

Hygienic

ADVANTAGES OF TFM AND 3DL in Health Care



• **ABOVE** The seamless construction of 3-D laminate/TFM panels minimize contamination and make cleaning and upkeep easier in dental operatories.

Few environments are more demanding on their surfaces than dental and medical offices. Frequent traffic, medical tools, and constant cleaning with harsh compounds take their toll on both vertical and horizontal surfaces. That's why Midmark Corp. has embraced MDF doors and drawer fronts, surfaced with 3-D laminates on one side and matching melamine on the other.

"In health care environments, they need a surface that's easily cleaned to keep bacteria and viruses from getting a foothold on the surfaces," says Scott Strait, engineering manager for Midmark's Dental Casework Products. "So when we look at a material, one of our biggest prerequisites is that it will last in the environment and is easily cleaned.

"We've been using 3DL for 20-plus years because it allows us to eliminate the front seam from the edge of the cabinets. You don't want any fluid leaking into the core of the board through those seams—one, to prevent contamination, and two, so you don't have to worry about the core swelling from moisture involved in the extensive cleaning in these environments."

Strait says Midmark has taken its products'



hygienic advantages one step further by designing recesses for door and drawer pulls right into the 3DL panel, eliminating additional seams and joints. "We did this in 1998 and no one else has yet used that concept, which gives us a great selling point with our customers."

The durability of 3DL components has been impressive, adds Strait. "We have an excellent service history; the replacement rate for doors with 3-D laminates is very, very low. I've been in installations where our product has been in use for many years, and it's still holding up well. You don't see the chipping and scratching like you see on some of our competitors' products. Material-wise, for the environments we're working in, this is an excellent option."

• **ABOVE** Midmark purchases 3-D laminated doors and drawer fronts to match its TFM casework.

Known as thermally fused melamine (TFM) panels or direct-pressure laminate, these products quickly proved themselves durable enough for vertical and many horizontal applications, even comparing favorably to HPL in wear resistance (impact resistance too, with a high-density substrate), thereby offering a lower-cost and truly "value-engineered" option. TFM's edges are finished with the same materials you'd use on an HPL panel.

Its limited initial color offering, however—white, almond or gray—relegated TFM largely to cabinet interiors and other pedestrian applications. A small range of colors, woodgrains and abstract patterns found their way onto TFM, but manufacturers remained focused on large-volume single-color runs to maximize efficiency. Switching décor papers too often "wasted" valuable press time.

Then, Pergo happened.

Pergo, of course, is laminate flooring, which nearly everyone knows by now. What few people realize though is that Pergo is TFM. The shear volumes involved in producing flooring for consumers pushed the TFM industry into overdrive, creating higher density MDF cores, more wear-resistant melamine overlays to protect the decorative layer, and high-precision fabrication technology.

This rush to floor the world also required TFM to finally embrace a wider variety of design. Striving for ever-greater realism, producers pioneered advanced technologies like sophisticated surface finishes and in-register embossing, with which the woodgrain surface texture aligns perfectly with the "ticking" printed on the décor paper. Extremely stable and thin grades of MDF

were engineered to resist impact, less-than-perfect installation techniques and even the levels of direct moisture encountered in bathrooms.

These important innovations reinvigorated TFM suppliers' vision of what the material could bring to a wider range of furniture and interior applications. And with a design range as far-reaching as HPL, TFM is now increasingly specified for casework, worktops and even wall paneling in hospitality—a perfect value-engineered alternative for veneers, metals, and other materials in health care, retail, food service, corporate, and other applications.

In addition to TFM's value as a durable, cost-effective material choice, specifiers are also drawn to the material's inherent environmental benefits:

- It consists of wood fiber wasted by other processes that would otherwise be landfilled or burned
- It's manufactured in efficient, state-of-the-art plants located throughout North America
- Water-based inks are used in printing the decorative layers
- Specifying a cherry, walnut, zebrano or wenge surface has zero impact on those, or any other, precious wood species
- Because of its durability, its useful life is years longer than a veneered or solid wood component

FORMALDEHYDE, MELAMINE AND THE TRUTH ABOUT IAQ

Both formaldehyde and melamine are used in the production of TFM, and both have

Lasting

VALUE IN A Children's Hospital

The University of Wisconsin-Madison's American Family Children's Hospital greets visitors with an atmosphere designed to put young patients, and their families, at ease. The comfortable rooms, as well as nurses' stations and administrative areas, are adorned with cabinetry in homey woodgrains, made mostly of particleboard-based TFM panels.

"We love the quality and longevity of the TFM panels," says Ardis Hutchins, AIA, IIDA, AAHID, and the

hospital's internal architect. "These designs are the culmination of years of experience at our other facilities, so we know we've got the right configurations and that they're made of materials that will stand up to heavy use."

Cost of ownership was calculated to include ease of maintenance, and for cabinets that are designed and durable enough to be "repurposed"—i.e., they can be pulled intact from their mounts, moved and reinstalled as configurations or design themes change.



LEFT + BELOW TFM panels were chosen for the University of Wisconsin's new children's hospital based on past experience with the material's durability, and because the design added to the project's welcoming atmosphere.

PHOTOS: KENN BUSCH



been featured in health-related news stories lately, so it's important to know the facts.

Almost every living organism emits formaldehyde, including human beings. It occurs naturally in the air we breathe, the foods we eat, and the wood used in furniture and panels. In very high concentrations it can cause irritation of the eyes, nose and throat. It has been indicated in some reports to be a "known human carcinogen," although other scientific data refutes this.

What is known is, at typical day-to-day levels of exposure, the risk of related cancer is essentially non-existent. This exposure includes formaldehyde's use in pill coatings, cosmetics, vaccines, wall coverings, shampoo, cleansers, disinfectants, and wrinkle-free clothing products, to name just a few. We also know that it does not accumulate in our bodies, and is broken down when exposed to sunlight.

Urea-formaldehyde is the basic building block for adhesives, like those used to bind the elements of particleboard and MDF. Different adhesive formulations carry different levels of formaldehyde, and manufacturers are switching to "no-added formaldehyde" adhesive systems that satisfy new indoor air quality limits like CARB ATCM (California Air Resources Board Air Toxic Control Measure).

While the CARB standard applies to raw panels, it's important to note that when a panel is laminated it is essentially sealed, reducing even these safe emission levels by up to 98 percent.

Melamine formaldehyde resin is impregnated into the decorative paper and wear overlays as a bonding agent. This resin system is what bonds the surface to the panel in the TFM press—no additional adhesives are used. The production of melamine crosslinks the formaldehyde component more completely than in urea-formaldehyde, minimizing the potential for emission.

You might be familiar with melamine resin products from your grade school days; e.g., the indestructible plastic plates and cafeteria trays you still find there are made of melamine.

3-D LAMINATES AND MATCHING SURFACES

In recent years, TFM has been increasingly mated with 3-D laminates (3DLs) in unique and functional component designs. 3DLs are thin, formable overlays created from PVC or polyethylene polymers in solid colors, metallic and printed designs (also known as rigid thermofoils [RTF] or vinyl films). They can be specified in a variety of surface textures, including realistic woodgrain ticking and high-gloss, as well as with enhanced chemical resistant properties. Many 3DL products offer wear resistance comparable to that of HPL.

3DL is unique in that it can be pressed onto a panel, usually MDF, with 3-D details machined into its edges or face, as well as onto unconventionally shaped panels and panel edges. A heated pneumatic membrane literally squeezes and stretches the 3DL into and over the recessed and edge details of the panel. The material's ability to "self edge"—wrap seamlessly around the edges and interior cut-outs of a panel—reduces processing steps and helps seal the panel core from moisture and bacteria. This ability also helps create "soft" edges that mimic shaped solid wood or stone.

Typically, a 3DL component will have a melamine decorative surface on one side, and 3DL on the other five. Many TFM and 3DL suppliers share design data for perfect matches on such panels, so when you open that woodgrain cabinet door, for instance, you're not shocked by a solid white back.

3DL components have gained popularity as the office furniture industry has embraced nonstandard shapes and soft edges for worktops, and are increasingly being specified for unique store fixtures and displays. They are also commonly found on cabinet doors and drawer fronts, and are making their mark in health care applications because of their seamless construction and ease of cleaning.

In many ways, TFM and 3DL are a perfect design match, but there are still more matching material options—in HPL for the highest wear surfaces in

Design

FLEXIBILITY + SAFETY

in Retail

When a retailer's image is at stake, two basic demands are made of fixtures: they must be unique, and should look good even after months or years on the floor.

In both cases, the 3DL/TFM combination has proven an effective solution. Bumping the squared edge of a standard panel with a shopping cart will eventually cause chipping or delamination. With the rounded edge or corner of a 3DL panel, the risk of damage is much lower. And when toddlers topple headfirst into a lower shelf, they won't be met by a sharp edge.

Triad Manufacturing has been supplying displays to Best Buy with 3DL on tops and sides for some time now, and for the first time introduced concepts for other clients at this year's GlobalShop. Visual design coordinator Paul Meyer is pleased with the response.

"We had been hearing about 3-D laminate as a retail surface for a while, and thought, 'If we don't show it now, it's going to look like we missed the boat.'

"So I designed a three-level



surfboard shelf to show off what the material can do," says Meyer. "The top shelf is the surfboard, and the lower two look like waves. When people see it, they have to come over and touch it; they love the feel of the 3DL.

"I think designs that make the most of 3-D laminates will be popular in youth-oriented retail because it's so easy to do something hip and trendy with it. You can machine logos, graphics, and other functional or decorative details into the MDF panels, and when you surface them with 3DL you get a very cool, very durable component."

"Designers at GlobalShop liked that they could get so many different looks out of it," says Tiffany Bentley, Triad's marketing coordinator. "Routed out shapes, any kind of edge or profile ... we had an overwhelming response because most people had never seen those looks before. When they couldn't find an edge seam they were usually confused for a moment, and then they were really impressed."



LEFT + ABOVE 3-D laminates, mated with TFM panels, allow Triad to create unique shapes and soft edges that set their designs apart.

PHOTOS: KENN BUSCH

a project, and in decorative paper overlays for light-duty vertical and interior casework surfaces, and, of course, edge treatments. If veneers are part of your project, they can be finished to match the TFM/3DL if necessary.

With so many surface options and application-specific mechanical properties, the TFM/3DL combination is poised to be a benchmark building block for modern interiors and furniture. Factor in its frugal use of raw materials and environmental friendliness, and it quickly rises to the top of responsible material choices. ●

Freelance journalist and photographer Kenn Busch has been covering the furniture industry since 1990, and publishes www.materialintelligence.com.

To receive one hour of continuing education credit (0.1 CEU) or one AIA Learning Unit (LU), read the article and go to www.interiorsandsources.com/ceus and follow the instructions.

Transcendent Design,

Performance-Engineered Materials



When it comes to finding the perfect aesthetic for a project or product launch, design not only defies categorization; it transcends materials.

While you can now specify a particular design on any number of laminate materials, thermally fused melamine (TFM) panels from Flakeboard are becoming the standard by which other decorative and performance surfaces are measured.

They're durable enough for high-use work surfaces, created in state-of-the-art facilities using

waste wood fiber that would otherwise be burned or landfilled, and carry an unlimited variety of designs.

Inspired by contemporary European furniture, Flakeboard's 2009 design introductions are based on refined pears, stylish walnuts and rare exotics. The new Cocktail Series, for instance, entices with crisp detail and a subtle tonal flow from highlights to shadows, while the bold character and higher contrast of the Exotics add a little spice to any application.

For more information, including the LEED-related advantages of Flakeboard TFM, please visit www.flakeboard.com.



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Vanilla Stix WF294
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FLAKEBOARD'S 2009 DESIGNS
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Arclin's E-Gen initiative: Enhancing product performance while reducing our environmental footprint.

E-Gen: A New Standard in Environmental Responsibility

Engineered decorative products like TFM panels offer a range of environmental and performance advantages, aided in no small part by the expertise of companies like Arclin.

Arclin supplies decorative melamine overlays and internal binders to producers of TFM, and is a leader in meeting or exceeding standards for environmental sustainability.

Products that carry the company's E-Gen™ trademark help TFM products earn LEED credits for indoor air quality, waste reduction and more:

- The majority of Arclin's E-Gen designated overlays are GREEN-GUARD for Children & Schools™ certified, satisfying the most stringent emissions standards.
- Select papers used in Arclin's decorative overlay products are FSC Certified.
- Arclin's E-Gen resin binder systems for composite panels are CARB Phase II compliant, the world's lowest emissions standard available. They also qualify for LEED credits under EQ Credit 4.4.
- Arclin's E-Gen initiative - Enhancing product performance while reducing our environmental footprint.

For more information on Arclin and its products, please visit www.arclin.com.



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