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VINYL UPDATE

Meeting Demand for Color

Choosing an Impact Design

Choosing Coatings

for Composites and Fiberglass

Manufacturers can find many options to suit their performance and processing requirements

By Chuck Susnis, Sherwin-Williams

Since the mid-1990s, composites have made huge inroads in the window, door and architectural moulding industries. Their low maintenance, unprecedented strength and resilience have made these materials too good to ignore. They also offer another advantage important in today's building industry—"green" appeal. While they are produced using petrochemicals, composites are often comprised of recycled materials and therefore reduce the harvesting of lumber.

Industry experts say that demand for wood/plastic composites (and plastic lumber) in the United States is forecast to expand 11 percent annually through 2009 to $3.5 billion, with dramatic gains in moulding and trim applications in particular. In the meantime, wood sales declined slightly in 2005 in the window and entry door market.

Fiberglass window sales increased by 14 percent in 2005 and sales of fiberglass entry doors rose by a whopping 40 percent, according to a recent Ducker Research survey (fiberglass is not technically a composite, however it shares many similarities with composite substrates and will be discussed in this article.) Use of cellular PVC and urethane foams by the building construction industry is increasing also.

Like natural wood, these materials can be finished in any number of colors to suit their end use. But composites are most often pre-primed and pre-finished at the factory under controlled conditions, arriving on the jobsite ready for installation—a plus for builders and installers working year-round who would otherwise have to paint on-site. Back at the factory, however, the coating of composites can pose certain unique challenges.

COMPOSITE MATERIALS

Composite technology has improved over the years, making today's composite materials more attractive and durable than earlier composite building materials. As their name implies, composites, such as those used for window and door profiles, are comprised of resins and either glass or wood fibers, blended to create new and better building materials for both interior and exterior applications.

The three major types of composite materials used by window and door makers today are glass-reinforced thermoset pultrusions, wood-reinforced extruded thermoplastic resin, and glass-reinforced thermoplastic resin. More than 80 patented composite materials fall into these categories.

Each of these composite types is produced using very different resins and manufacturing processes. The resin used affects the physical and performance characteristics of each resulting composite, as does the thermosetting temperature and the forming of the end product. Since there are so many proprietary formulations, there is no "standard" composite and no "standard" or "off-the-shelf" coating system appropriate for all composites.

As composite formulations have improved, so, too, have coatings for composite substrates. Choosing coatings for composites, then, requires a search for the correct coating system match. This article will cover the different coating types available for composites, their benefits, and considerations in coating selection to make the process of finding a custom coating solution easier.

Coating suppliers can work with manufacturers to develop coatings for composite substrates that are formulated to meet specific requirements, and test those coatings using equipment and processes that closely simulate the customer's finishing operations.

COATING OPTIONS

The range of coatings for composites is quite broad, with many different kinds of chemistries offered. Water-reducible coatings that may be used on composites are available as polyurethanes and UV-cure formulations. Solvent-based coatings also offer choices in polyurethanes and UV-cure coatings, as well as acrylics and conversion varnishes. Which coating to choose depends on a variety of factors, including the particular composite's end-use requirements and profile, color, durability, and UV and chemical resistance.

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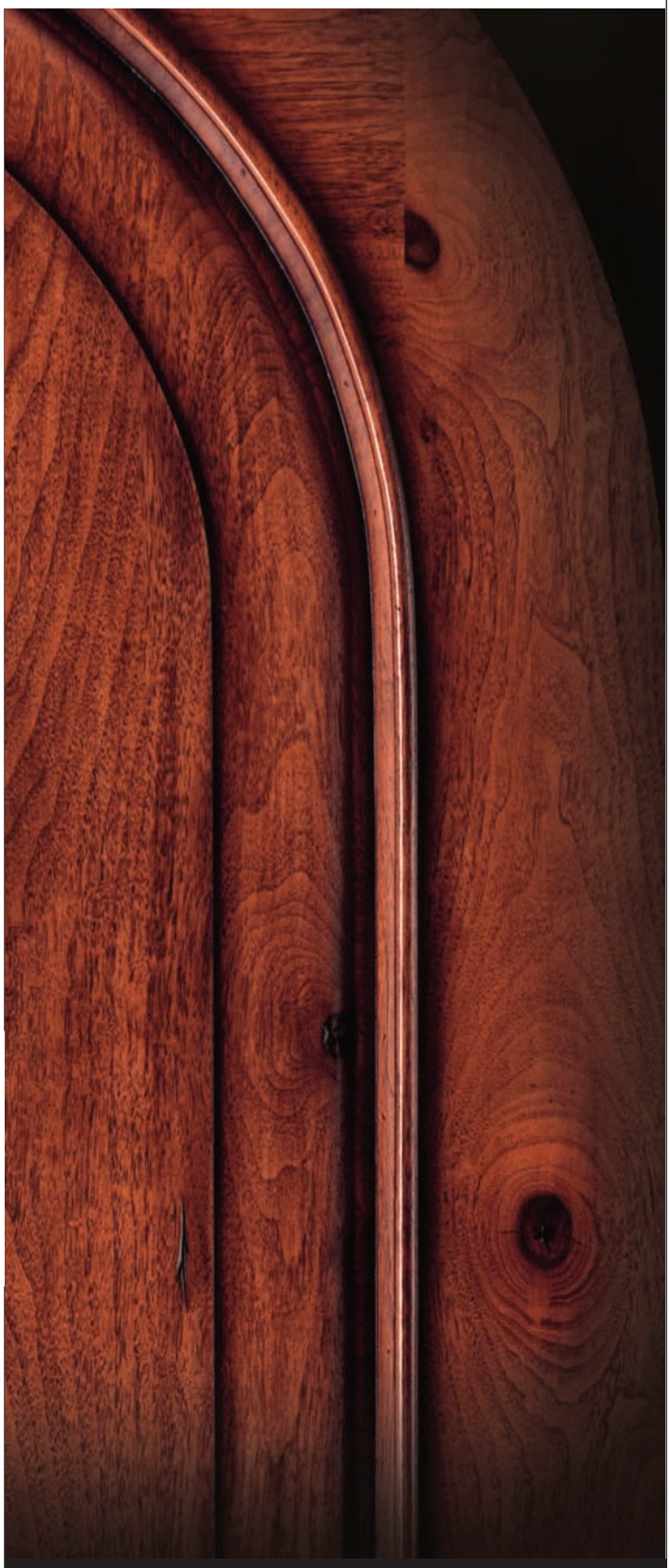
Another critical factor when considering coatings for composites is the composite maker's finishing line. The existing line may be more easily adapted to accommodate some coating types rather than others.

One of the most important coating types used on today's composites are polyurethane enamels. These coatings are setting new benchmarks for protection and lasting appearance. Some are available as two-component systems that provide excellent hardness, mar and abrasion resistance and color and gloss retention—all in a single pass. The durability of two-component polyurethane coatings comes from their cross-link density, which provides excellent depth of color and a distinctive finish for composite materials.

Polyurethane coating systems also offer environmental compliance. Some polyurethane enamels exhibit VOC emissions fewer than 2.8 pounds per gallon and have zero lead and chromate hazards. Depending on the particular polyurethane coating formulation, there are other distinctive benefits. For example, some polyurethanes have a high solids composition (59 percent by volume) that allows applicators to obtain a greater film build in one pass versus conventional urethanes, which can result in higher throughput. These coatings also tend to have excellent flow properties, which makes for good transfer efficiency and leveling. In addition, most polyurethane coatings can be applied by conventional, airless, air assisted airless, HVLP and electrostatic spray so they are easily applied on many finishing lines.

Another option for composites is UV-curable coatings, which can be formulated as epoxies, polyesters, urethanes, waterbornes and hybrids. UV-curable coatings are cross-linked coatings cured by brief exposure to intense



Advanced coatings help manufacturers like Jeld-Wen achieve a beautiful and durable finish on its fiberglass composite Aurora doors.

UV light, unlike other coatings that are dried with forced air methods. Depending on the type of UV equipment used, curing time can be just a few seconds, allowing an increase in line speeds since products can be handled and packaged immediately. Due to their configuration, flat-panel building products such as doors, window components and architectural molding are often well suited for UV coating lines.

Proven performance characteristics have made top-quality UV coatings attractive for many production lines. For example, these coatings are extremely abrasion, chemical, impact and scratch resistant and in most applications, they emit virtually no VOCs, so they meet federal, state and local environmental regulations.

Although UV coatings require a significant investment in finishing equipment, it is not unusual for owners to recoup their investment in a short period. As mentioned earlier, ultra-fast dry times increase productivity, which can lower labor costs and increase transfer efficiency, making UV coatings one of the most cost-effective methods available. Also, since UV equipment tends to be compact, considerable floor space can be made available for other uses. Some of the common automated processes used for applying UV coatings are spray, roll coaters, curtain coaters, edge or vacuum coaters, and electrostatic.

There is still a host of other coatings that provide a variety of performance characteristics, making them a good match for certain composites. Some fast drying latex coatings, for example, are water-reducible, VOC compliant and can be applied by various application methods. There are high-performance conversion lacquers that dry quickly and have very good resistance to household chemicals, stains and marring. These coatings may also be HAPs-free (HAPs are hazardous air pollutants limited by environmental regulations) and ready to spray with conventional spray equipment.

Other options include CAB-acrylic catalyzed finishes that have very good non-yellowing properties and good abrasion resistance. Some conversion varnishes offer excellent resistance to moisture, chemicals and marring. Like many of the coatings mentioned here, many conversion varnishes dry fast and are in compliance with HAPs regulations.

Powder coatings are often an excellent choice for certain plastic and fiberglass substrates, and recently a new generation of low cure temperature powder coatings is bringing the benefits of powder to composite substrates such as MDF, plastics, wood and other heat sensitive substrates.

Powder coatings are environmentally friendly, available in a wide range of colors with excellent color matching and can be formulated to meet exacting specifications. These dry, 100 percent solid coatings are electrostatically spray applied in a process similar to the application of liquid coatings, then cured in a curing oven. During curing, the powder melts to form an attractive, lasting finish.

Powder coatings are available in different chemistries including epoxy, polyester, hybrid and polyester urethane so one or a combination of desirable physical and performance characteristics can be achieved. Each chemistry offers its own set of capabilities for hardness, flexibility, overbake stability, resistance to chemicals and solvents and ease of application.

➤ Having input from knowledgeable coating experts is extremely helpful.

One of the key benefits of powder coatings is that up to 99 percent of overspray can be captured and recycled. Typically, adequate coverage of part contours can be obtained in one coat without runs or sags, and reject rates can be kept low.

While a substantial investment in new equipment is necessary for powder applications, many owners find their return on investment coming from the long-term benefits of providing flawless finishes that are efficient and environmentally preferable.

JOINT EFFORT IS KEY

While having a basic understanding of a variety of coatings is important, having input from knowledgeable coating experts is extremely helpful. Coating manufacturers with a strong commitment to the building products industry will work closely with the makers of building products on every coating specification. Since no two production facilities are exactly alike, some coating manufacturers will send technical experts on-site to assess equipment options and to study production objectives and finishing quality standards.

Calling in a coatings manufacturer early in the product development cycle can streamline the process of choosing the best coating for a composite. Input from coating experts and information exchange during research and development and process engineering can help to meet fast-track product development schedules. Some coating manufacturers can replicate the customer's coating line at their own labs, running their own batch tests and expediting testing for the customer.

Production space, energy, reclaimability, transfer efficiency, throughput and color palette are among the considerations coating experts will help composite makers consider. With planning and teamwork, the result is better and more efficient production of composite building products. ⊞

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