Case Study No. 7 UV-Cured Coatings
Columbia Forest Products
Chatham, VA

Background

Columbia Forest Products has 18 plants throughout the United States. The Chatham plant is the only plant that coats its product. A wide variety of hardwood plywood panels are produced, with approximately 10 percent receiving a clearcoat on one or both sides. The coating process includes a UV-cured sealer and a UV-cured topcoat. The panels are either multi-ply, with a core consisting of three or more sheets of thick veneers pressed together, or three-ply, with a solid core of premanufactured particleboard or MDF. Panel thicknesses range from 5/32 to 1½ inches and panels range in size from 30 to 50 inches in width and 5 to 10 feet in length. The finished panels are sold for use in a variety of applications, including cabinetry and casegoods.

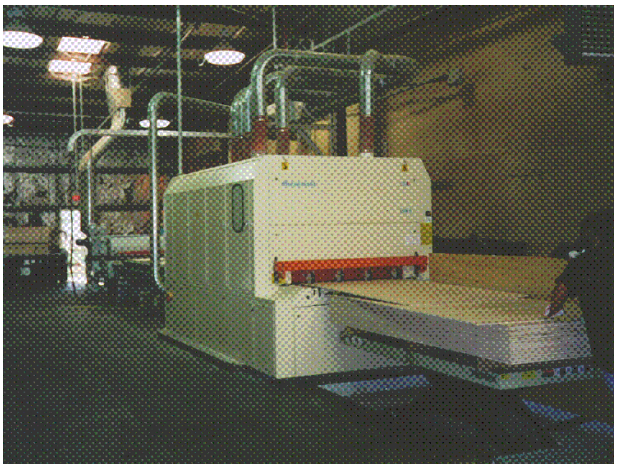

Product sample

Manufacturing and Coating Operations

The first UV coating line was instituted in June 1995 due to customer requests for a prefinished product, which was previously unavailable. Customer demand also played a role in choosing to use UV coatings over traditional solvent-borne products. Not only do UV coatings produce significantly less emissions, they are also more cost-effective for both Columbia Forest Products and the smaller companies they supply with finished panels. Since Columbia Forest Products produces thousands of panels per day, it is more cost-effective for them to supply prefinished panels than for each of their customers to coat the panels that they purchase, especially with the UV technology. In July 1998, a second UV line was added. The older equipment then became the topcoat application line, and the new equipment became the sealer application line. Before the addition of the second line, a panel had to pass through the finishing line twice per side, once for the sealer and once for the topcoat. The addition of the second line effectively created one single pass line. The finishing capacity was doubled, causing the plant to increase operation from five to seven days per week. There currently are two 12-hour shifts per day, with six coating employees per shift.

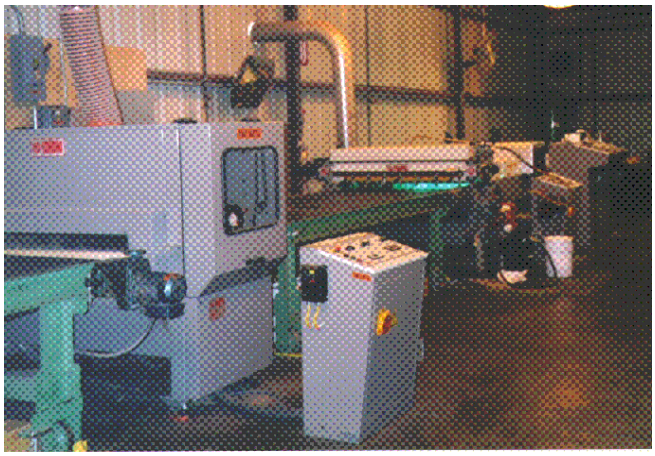
The panel materials are first matched and ordered according to customer request and then sent to the glue spreader. The bottom layer is laid face down and the core layer(s), with glue (a urea-formaldehyde resin) spread on both sides, is placed on top. The panel is completed by placing the face on top of the core. Several panels are assembled in this way and stacked together. The panels first are cold pressed and

then sent to a steam-heated multi-opening press. Following this hot pressing, the panels are trimmed on all four sides and voids are filled with putty. The panels then are stacked and sent to the sander. First the edges are sanded, then the back. The panel is flipped and the front is sanded last. The panels then are considered finished product. Most are packaged for shipping, but the panels that are to be coated are sent to the UV finishing line. Approximately 2,800 panel sides are coated per day.



Older UV oven

The UV coating line consists of two sanders, two roll coaters, and two UV ovens, connected by conveyor belts. The panels are fed by hand onto a moving conveyor belt and pass through the newer equipment to receive the sealer. The panels first pass through a multi-head sander that also cleans the panels for a smoother coating application. The sander exhaust is sent to a baghouse. The panels then pass through the roll coater where the sealer is applied. The coating is cured by UV lamps. The number of lamps and cure time vary depending on the product, however cure time is only a few seconds. The second half of the line consists of the older equipment. A conveyor transports the panels to this section of the line to receive the topcoat. Because the sander on this line does not also clean the panels, they must be sent through a separate cleaner after they are sanded. The topcoat is applied by a roll coater and cured by two UV lamps.



New UV line

All coatings are received in 55-gallon drums and transferred manually to the roll coaters using 5-gallon buckets. The empty drums are sold to a barrel company for reuse.

Facility Experience with UV-Cured Coatings

The addition of the UV line went smoothly for Columbia Forest Products. The main problem with the new UV-cured coatings is the difficulty of repair or rework. Because the veneer is so thin, the panel cannot be sanded to completely remove the coating without damaging the veneer. The UV-curable coatings cannot be sprayed over a small area to repair a coating defect the way traditional solvent-borne coatings can.

The difficulty of repair increases the number of rejects that must be sold as shop-grade panels.

The value of proper operator training was very clear at Columbia Forest Products. The addition of the new equipment, as well as the switch from five to seven days per week operation, added many new operators who had no experience with the UV line. Their lack of experience led to an increase in rejects and equipment maintenance, both of which declined as the personnel became familiar with the equipment.

There are several advantages to using the UV-cured coating system instead of traditional solvent-borne nitrocellulose coatings. Less paperwork is associated with the lower-emitting UV-cured coatings, a benefit enjoyed by both Columbia Forest Products and their customers. In addition, the short curing time reduces the amount of space required in the facility to house the UV line. The UV equipment also provides a highly automated coating process and requires a smaller labor force than hand spraying traditional coatings. The UV system produces a consistent, high quality finish that has resulted in high customer satisfaction. Overall, facility personnel are pleased with the quality and performance of the UV-cured coatings.

Costs

The major cost incurred as a result of the facility's decision to begin coating was the purchase of the new equipment. The capital investment for the first set of equipment was approximately $375,000; the line consisted of the sander, cleaner, roll coater, and UV curing equipment. The second line was slightly more expensive, approximately $500,000, because of an upgrade to the sander. The second line is made up of a sander with an integrated cleaner, a roll coater, and a UV curing station.

The in-plant trial period for both installations was very short. Most of the coating formulations had already been tested at the equipment manufacturer's on-site lab. The original coatings were supplied by R & D Coatings, who were very helpful in finding the proper formulation for the required finish. R & D Coatings also took two Columbia Forest Products employees to a plant that uses their UV-curable coatings to aid in operator training. After the initial training was complete, R & D Coatings maintained contact to ensure everything was going smoothly.

Columbia Forest Products tried several other coating suppliers as they were developing their coating process and is currently using both R & D Coatings and PPG Industries products. The UV-curable coatings are more expensive per gallon than traditional coatings (40 to 45 dollars per gallon), but facility personnel believe benefits like low emissions, high solids content, and customer satisfaction outweigh the cost difference.

Emissions

The majority of the facility's VOC/HAP emissions are from the plywood pressing process, due to emissions of formaldehyde and methanol from the adhesive and the wood as it is pressed. Another large source of emissions is the coating equipment

cleaning process. Propylene glycol monopropyl ether is used for in-place cleaning of the roll coating equipment. However, now that the line is running continuously, it is cleaned only when a roll is replaced. This practice has reduced the amount of cleaning solvent used, and therefore cleaning emissions, but no data on the size of the reduction were available.

Surface coating is not a major source of emissions, representing only 1 percent of the total facility-wide VOC emissions. According to the facility, coating operations accounted for only 0.22 ton of VOC emissions and represented only 0.5 percent (0.08 ton) of the total facility-wide HAP emissions in 1997. Columbia Forest Products stated that the UV-curable coatings have a very high solids content and a typical VOC content of less than 1 percent. The coatings also contain small amounts of HAPs (e.g., xylene and/or ethyl benzene) that are emitted during curing, but most of the coating components combine to form the final film.