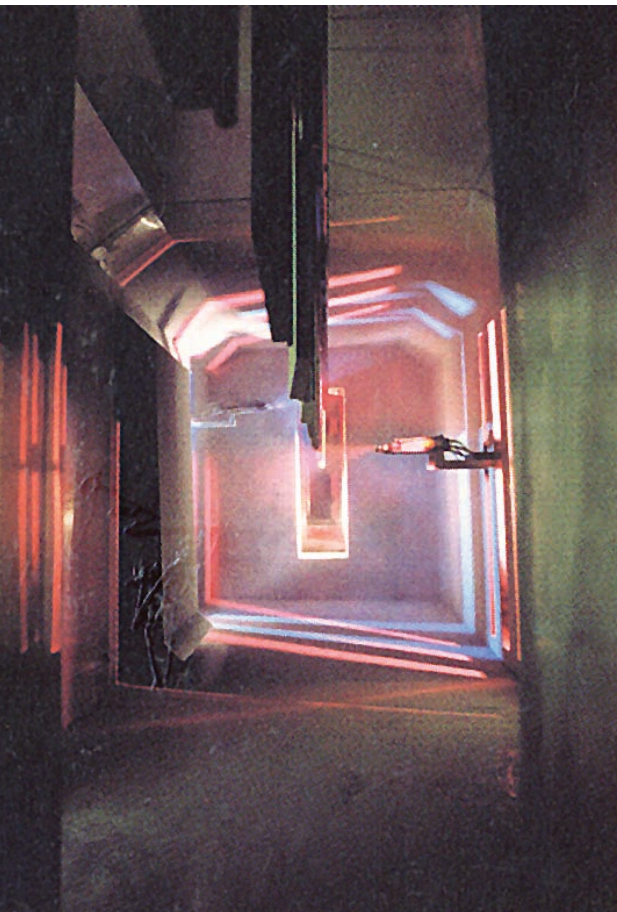


Technology Profile



Value
to
Wood

TP-04-02E
March 2004



Source: Du Pont Powder Coatings

Wood Powder Coating

Furniture is traditionally coated by one or more liquid products applied by an air pistol. The solvents used to ensure the fluidity of these products evaporate after application, and the resins contained within solidify to form a protective coating on the wood surface. In order to accelerate the polymerization of these products, the solvents are highly volatile and evaporate into the atmosphere. In 2004, the Canadian Council of Ministers of the Environment published directives (available at www.ccme.ca) for the reduction of volatile organic compound (VOC) emissions created during the finishing procedures of wood furniture. This document, which has been delivered to the provincial ministers who will decide whether to adopt its recommendations, suggests that the furniture industry could reduce VOC emissions and proposes limits. Modifications to environmental standards will force the furniture industry to reduce the volume of VOC emissions released into the atmosphere. It is essential that solvent-free wood-finishing systems replace traditional systems in order to respect the future VOC emission limits. The technology used for the application, the hardening method, and the product selected for the finish, include three key elements in the emissions reduction



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effort. The flat finishing technique used for furniture components before assembly allows for an efficient application of both water-based products and hardening products using UV rays. The solid content ratio and the recovery rate of the finishing products are quite high. The use of a roller to apply these products (as is commonly done in the wood flooring industry) is one solution that will respect the new VOC emission limits. The technique used for finishing three-dimensional products (multiprofile pieces, assembled furniture, etc.) requires application using a paint spraying device. By using liquid finishing products, the level of waste experienced during application is high, and the recuperation of the wasted product is difficult. Powder coatings have already been successfully used in the metal industry, but one question remains: is it possible to use powders to finish wood items and maintain the performance of traditional products? In order to answer this question and evaluate the use of powder coatings in the wood furniture industry, we need to understand the basic principles of powdered surface coatings.

A wood powder surface coating contains resins, a hardener, colour pigments, and additives. As in liquid products, several different types of resins such as polyester, epoxy, or acrylic can be used to transform a surface coating into powder. The basic product is obtained by extrusion and is then transformed into a powder. The powder is applied by pistol and adheres to the substrate by electrostatic force. The required electric field can be obtained by either charging the powder particles by a high-tension electrode installed in the pistol, or by charging the powder particles by friction within the teflon feed system. For each of these techniques, the object to be coated must be grounded. The substrate must have a surface resistance of less than 10^{11} Ohms, and the humidity of the wood must be above 6% to obtain an acceptable level of conductivity.

The substrate structure must be homogeneous, which is not the case for solid wood. The structure of medium density fibre (MDF) panels permits the application of a powder coating. The humidity level of a panel must be between 6% and 9%. A higher humidity level will result in the formation of surface bubbles and will increase the problem of checking. The quality of the underlying panel surface is very important for obtaining a high quality finish. The surfaces, especially the edges, must be well sanded. Panel producers in both Europe and the United States are developing improved panels to be used with powdered surface coatings for wood. Particular efforts are being made to improve conductivity, uniformity of the density profile, and the overall quality of the panels. Evidently, properties of the MDF panels can vary substantially from one panel producer to the other.

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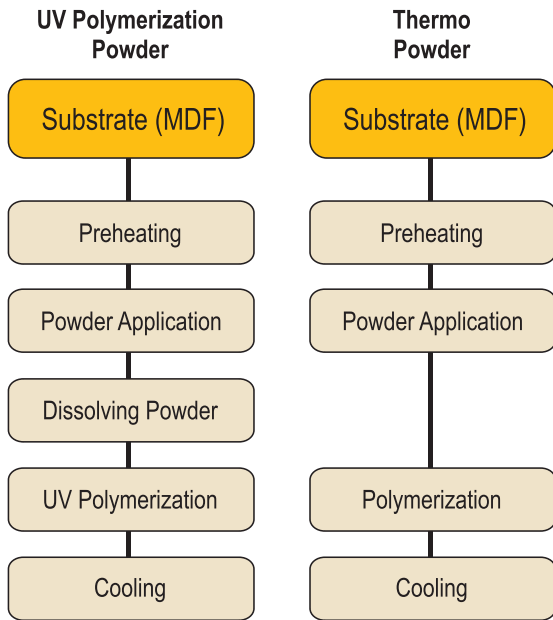
Source: Du Pont Powder Coatings

« The structure of MDF panels permits the application of a powder coating. »



Source: Du Pont Powder Coatings

Two kinds of powders are currently on the market: thermal polymerization powder and UV polymerization powder. The primary steps in the thermal process includes preheating the panel, applying the powder, and cooking. The UV procedure divides the cooking stage into two steps of dissolving the powder and applying UV rays for hardening. The preheating procedure permits uniformization of the humidity level and pulls the humidity towards the surface of the panel, thereby improving its conductivity. The following table shows the temperatures required at the different stages of finishing for one MDF panel, 19 mm thick.



	UV	Thermal
	Cycle time	
	Preheating: 90 seconds	Preheating: 15 minutes
	Hardening: 90 seconds	Cooking: 5 minutes
	Panel temperature (°C)	
After preheating	100	120
After application	60	85
While powder dissolves	110	-
During cooking	85	135

Source: Wood & Wood Products, 2003

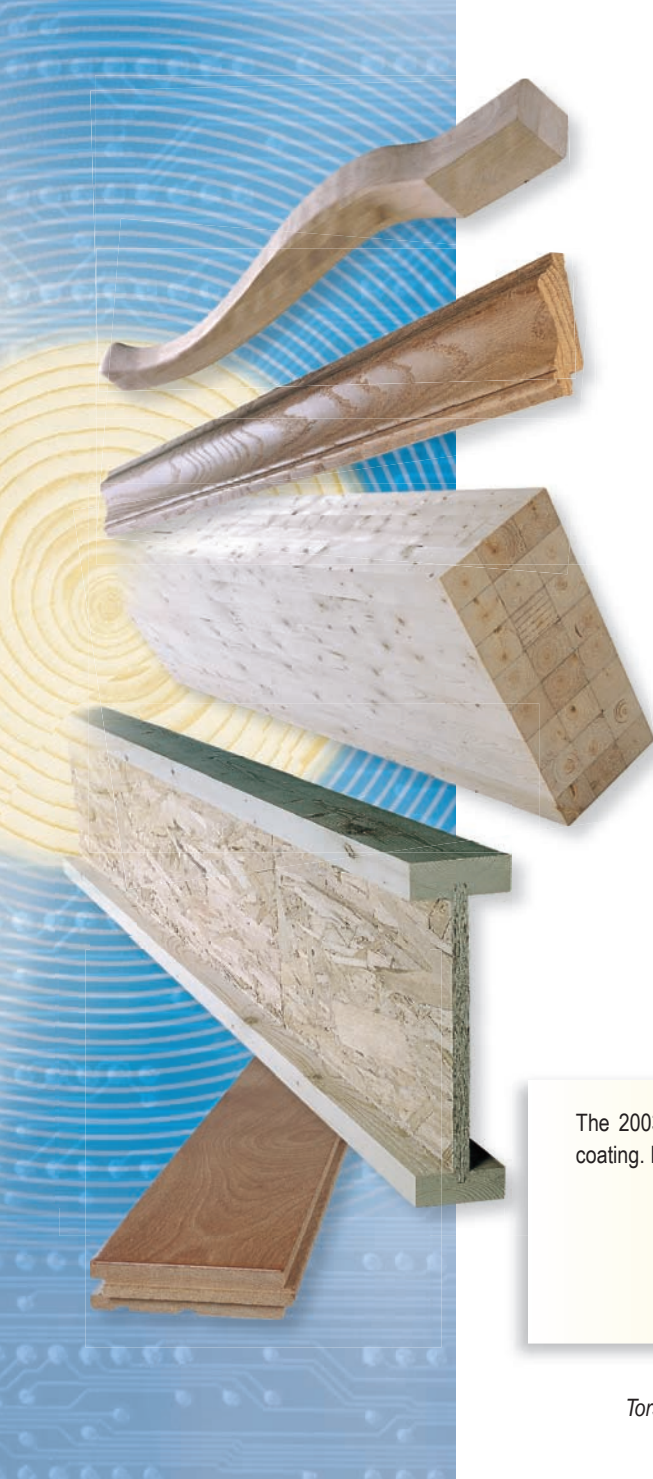
The UV-hardening process has two advantages: a lower processing temperature and a shorter exposure time to heat. The temperature at the centre of a 19-mm thick MDF panel reaches 60°C. The installation required for the UV-hardening process is more compact than the one required for the thermal powder process. This difference is caused by the length of the tunnel required for cooling the panels treated by the thermal powder process. The UV-hardening process requires that all of the surfaces be uniformly exposed to UV rays. This is difficult to accomplish when 3-D forms are used. The choice of UV powders is limited. Shades of yellow and a number of transparent coatings are currently being developed, but they are not yet ready for market. Thermal powders offer a wide range of both colours and textures. The adherence of the powder coating is good, and its scratch resistance to domestic products compares well with liquid-based coatings.

The inherent nature of the product and substrate orient the use of powdered surface coatings towards office furniture and kitchen cabinets. Rounded shapes and unconventional profiles can easily

Utilization of powder surface coatings in the furniture industry around the world

Countries	Number of enterprises
United States	21 (office furniture)
Italy	4 (office furniture, kitchen cabinets)
England	3 (office furniture)
Germany	1 (office furniture)
New Zeland	1 (office furniture)
France	1 (children's furniture)
Canada	1 (office furniture)

Source: XYLON, December 2003



be covered in a single step. At the moment, approximately 30 furniture manufacturers around the world use these powder-based technologies to put the finishing touches on their furniture. Acceptable results have been obtained for the powder finishing only when MDF panels have been used as a substrate. The office furniture industry is one of the greatest users of this kind of panel, and it is now beginning to use powder finishing on certain targeted products. These products often have contemporary styling and rounded forms. The costs incurred for the powder finishes are below the costs required for liquid-based finishes, primarily because the powder finishes can be applied in a single coat.

Powder-based finishes are an alternative to liquid-based finishes and respect VOC emission limits. In the marketplace, the new improved MDF panels and the continuing development of powders will help the implementation of this technology in the furniture industry. At present, opaque and metallic are the finishes used most commonly by office furniture manufacturers, however we anticipate that the use of this technology will increase in the furniture industry in the years to come.

The 2003-2004 *Value to Wood* research program includes various projects related to wood powder coating. For more information, visit www.valuetowood.ca (Research and Development).



*This Technology Profile has been edited by
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Ce Profil technologique est également disponible en français.



As part of the *Value to Wood* program, funded by Natural Resources Canada, Forintek's Industry Advisors are providing technical services to value-added wood product manufacturers in all regions of Canada. If you need information on any technical issue related to wood product manufacturing, you can:

- Send a request via valuetowood.ca (Help Desk).
- Contact a *Value to Wood* co-ordinator at one of the following locations:

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