

There is a brighter future for UV cured powder coatings, writes **Michael Knoblauch**.

To a brighter future

It has been five years since the spotlight began to shine on UV cured powder coating as a transforming finishing material and process technology. Looking forward, the future for UV cured powder coating looks brighter than it has since 2002. Across continents, industries and markets there was much anticipation of an immediate acceptance and a steep upward slope of the demand for and the capacity to produce UV cured powder coated products. It is fair to say the acceptance has been slow in coming and the amount of manufacturing capacity has remained stagnant. This is a good time to take a measure of UV cured powder coating, assessing its relative performance in the market place and make some assumptions concerning its future.

The years 2000 & 2001 were a time of excitement, evaluation and investment in UV cured powder. Finishing plants came on line in Europe and North America, supported by resin, powder formulators and equipment manufacturers. Powder formulators spent were spending heavily on material science R&D and capital equipment companies were making forecast strong sales forecasts for the following years. By the mid-point of 2002 capital equipment sales had stalled and the powder formulators had cut back on R&D and market support. These actions were the result of the 2001 - 2004 economic downturn and recession that swept across global economies and markets. It is impor-

tant to recognise that Nevertheless, in the face of these trying economic conditions the existing UV cured powder coaters continued to develop their businesses supported by the powder formulators who continued to manufacture UV cured powder.

The intervening years have only served to demonstrate the validity of the financial decision criteria used to evaluate and justify the UV cured powder coating system investment.

A UV cured powder system is compact, efficient and reliable, and is capable of finishing small to large volumes and wide variety of sizes, shapes and designs of MDF parts in an almost infinite mix of colours, textures and glosses of UV cured powders.

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Mr. Knoblauch joined DVUV in 1987 with a background in Operations, Information Technology, and Management. Mike led the development and implementation of DVUV's new UV Cured finishing technology. Mike is recognised both in the US and Europe as a leading expert in the UV cured powder process. Since 1987, Mike has been involved in the management of DVUV. Mike is active on a number of Boards and trade organisations, where he is frequently a speaker. A lifetime resident of the Cleveland area. Mike has a BA in History and Masters in Business Administration from John Carroll University.

UV cured powder coat

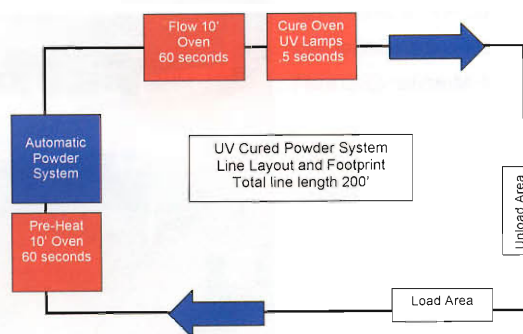
Operating at optimum capacity a typical UV cured powder system annually can finishes capable of finishing in excess of 20 million square feet of material per year. It is critical to understand that this is one pass finishing and includes of all surfaces; edges, cutouts and backside if required. This data clearly demonstrates the volume and throughput capacity of a UV cured powder coating system. Additionally, high output in relation to the system's compact footprint makes good economic sense from the standpoint of the small amount of in-plant real estate as a portion of the total capital investment.

As illustrated above, the The pre-heat and flow ovens combine gas convection and electric infrared heat

not cause thermal damage to the substrate eliminating the risk of post cure cracking of the substrate.

A UV cured powder coating system does not require any special or unique powder application equipment. Using automated powder application equipment it is possible to control exactly the amount of film build on each surface face assuring good coverage, desired cosmetic appearance and most importantly control of the volume of applied powder. The use of reclaim modules and quick colour change systems can generate additional system efficiencies and applied cost reductions.

There are four powder formulators supporting the UV cured powder market, DuPont, H.B. Fuller, Protech and Tiger/Drylac. Each firm comes to market with a distinctive marketing



systems. This combination heat system produces even heating across each part assuring consistent UV cured powder deposition. Proper wetting and flow is necessary prior to UV curing. Operating at 10 per minute, a part moves through each oven in 60 seconds. Low oven temperatures and short dwell times do

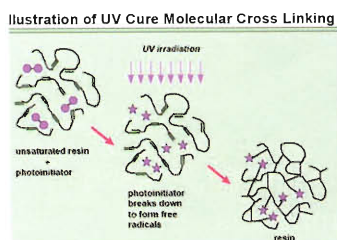
and product mix. The lack of a standard product range of finishes is a constraint on developing market penetration of UV cured powder coating; there is very little shelf stock of UV cured powder coatings. At this time, most finishes are either custom or are made from a finish standard produced for a prior project or customer.

UV cure The differentiating characteristic

The Cure cure technology is the differentiating characteristic that distinguished UV cured powder coating from thermoset and low temperature thermal powder coating. The UV curing process separates the wet and flow stages stage from the cure stage of the process. In thermoset powder coating wet, flow, gel and cure occur in one very long thermal process oven. A thermoset oven is often in excess of 50 linear feet. A lengthy post cure cooling process, often in a cooling tunnel, is needed to reduce the part temperature to point it can be handled. In UV cured powder coating the flow oven develops the inherent colour, texture, gloss and surface performance attributes of the finish.

Cure begins and ends when the UV light energy from the UV lamps activates photo- initiators that are part of the UV powder formulation. The UV light energy instantaneously creates molecular cross-linking and polymer bonding throughout the finish. At the end of the UV cure stage the average surface temperature of the part is less than 150OF and cure is certain.

Illustration of UV Cure Molecular Cross Linking



Performance properties of UV cured powder coating

Performance property measurements are an important function of material evaluation. UV cured powders have excellent surface performance in the areas of abrasion, hardness, scratch and stain resistance. Typically, UV cured powder will measure in the 4H range on ASTM D3363 Pencil Hardness and performs exceptionally well in Taber Abrasion ASTM D4060

testing. With a CS-10 Wheel, 500 MG load and 500 cycles the test result was .09MG loss, far under the minimum requirement of not more than a 50 MG loss.

One current limitation of UV cured powder is the inability of the UV cured powder formulators to produce an acceptable smooth texture and matte finish in the <5 units of gloss range. UV cured powder coatings perform best with a minimum of a micro-texture surface and with a gloss range of 5 to 50 on a 600 degree scale.

UV cured powder coating is a proven finishing technology that combines two important attributes.

Finish Attributes

- Colour – Texture – Gloss
- Certain and instantaneous cure
- High performance finishes
- Material flexibility
- Design differentiation

System Attributes

- Speed of one pass finishing
- High throughput volume
- Consistency of finish processing
- Energy efficiency
- Environmental safety

Market Acceptance

Accepting its unique combination of finish and system attributes it is reasonable to question the market acceptance and future of UV cured powder coating. Resin and powder formulators, equipment manufacturers and UV cured powder applicators agree that the penetration of UV cured powder coating has not come close to meeting the expectations of 2000 and 2001. Analysis of these past years indicates a number of reasons for the failure of expectations, and a clear understanding that there is an ever increasing rate of market success.

A key market failure was confusion resulting from the introduction of the Morton Powder Coating Lamineertm thermoset on wood program concurrent with the development and installation of North American UV cured powder coating capacity. Lamineertm

was heavily subsidised and supported by Morton. Two key elements of Morton's this competitor's strategy were to develop brand awareness and create an applicator distribution channel. A number of Lamineertm facilities were constructed in this period. Morton had greater resources in the market at the same time that two North American UV cured powder systems went online and the two industries' market strategies were very different. The Morton strategy was to create pull through the channel mechanism creating brand awareness and push by setting up an application channel. The UV cured strategy was all push as the illustration below describes. Ultimately, Rohm and Haas, the parent company of Morton, abandoned the marketing and sales effort, and wrote off the entire cost of the Lamineer program. Thermoset and low-temperature thermoset capacity still exists in the market, competing with UV cured powder coating.

The UV cured powder applicators, the smallest, with the shortest market reach and least capitalised firms in the industry funnel have been and continue to be the market builders of the UV cured powder coating industry. Each firm has successfully developed a customer and market base that has embraced the attributes and benefits of UV cured powder coating. As the market is currently structured, the future of the UV cured powder coating market will be determined by the success of the UV cured powder coating applicators.

Product Applications

UV cured powder coating is extremely flexible in terms of the sizes, shapes and type of substrate used in finishing. Standard 47-pound density MDF from a number of mills is suitable for finishing. Virtually any design machined in MDF can be finished. Panel thickness can range from .25" to glued up panels in excess of 2". Work is being done to extend the

application of UV cured powder coatings to other types of heat sensitive materials; plastics, assembled products, sheet molded compounds, bulk molded compounds and ceramics.

Conclusion

Success is often incremental, measured over years and many times the result of an unplanned or unforeseen event.

Taking a measure of UV cured powder coating and evaluating its success is a difficult process. The market is small, the UV cured powder coating applicators are privately held, and very little if any UV cured powder industry production information is available. Empirical market information would suggest that UV cured powder coating has a problematic future.

However, closer evaluation of the finish and process attributes of UV cured powder coating suggest a much stronger and more certain outcome for UV cured powder coating. Global energy costs and consumption patterns have changed radically. Energy as a percent of total cost of UV cured powder coating is very low. Additional process improvements can further reduce the energy cost component.

The demand for market wide environmental improvements is increasing. Large product companies have already or are in the process of eliminating PVC (polyvinyl chloride) components from their supply chains. UV cured powder coating is a better than equal finish substitute for PVC film.

UV cured powder coating produces a product of high quality, durable finish, infinite design & finish flexibility, one-pass processing, is energy efficient and environmentally friendly. This combination of attributes is extremely competitive, over time will achieve greater market acceptance and has an increasingly brighter future.