Breaking thru a Paradigm

New technology for coating and laminating

By

Mike Budai

Lamination and Coating Manager

ITW Dynatec

The purpose of this presentation is to break thru a paradigm. Laminating nonwovens, textiles, and composites have been done for many years. Traditional methods include needle punching, ultrasonic's, roll coating, scatter coating, and flame laminating. These technologies have served the industry very well for many years. However, change is in the wind. Competition is nipping at your heals. We must constantly be looking at new and different technologies to reduce costs, provide higher production rates, reduce scrap, provide more flexibility, as well as new product possibilities.

Our purpose is to introduce the latest technologies in coating and laminating utilizing hot melt polymers. We will learn the function of hot melt polymers and how they are used. For those of you who are not currently using hot melt polymers, saying the word hot melt is like saying the word car. Hot melt adhesives come in a large variety of polymer chemistries. For example there are EVA's, APAO' s, PSA' s, PE's, polyamides, PUR's as well as others. Hot melt adhesives can come with a large variety of additives to produce a particular affect on a substrate. For example you can add flame retardants, anti-microbials, antioxidants, UV inhibitors, and water repellents. In many cases, the additives can be a lower cost alternative. Water repellents for example are less expensive than the traditional flouro- carbons while providing a much safer water repellent that is not airborne and does not require special handling of wastewater. This would also be true for the anti-microbials additives. Hot melt polymers become a very cost efficient alternative for coatings in many cases replacing different emulsion or foaming operations. Hot melt coatings can be used to provide structural integrity

to the fabric or a substrate while still maintaining a soft hand. The different hot melt additives can give the textile certain characteristics such as waterproofing and yet maintain a huge temperature range. In addition to providing unique characteristics for the textile, hot melt coatings also provide many additional advantages over traditional coating methods including lighter coat weights, faster production speeds, energy savings, alleviation of the environmental issues, and the ability to work toward carrying a green label.

To make a product green it needs to have two primary characteristics -it must be both biodegradable and recyclable. Most hot melts contain the primary ingredients of Oils, waxes, and resins. This makes most hot melts totally biodegradable. Most hot melt adhesives do not carry any VOC;s or solvent-based emissions. Because hot melts do not contain water nor are they atomized, there are no airborne contaminants or wastewater issues to contend with. In addition, no drying ovens are required. Because most hot melts are a thermoplastic and in most cases the textile is also a thermoplastic it allows the product to be more easily recyclable. This would not be true if the product contained latex type emulsions. Now that we have a better understanding of the characteristics and the benefits of hot melt let us now move on to be application equipment.

There are many different types of hot melt application equipment but all of them will contain three fundamental elements. They will have an ASU which is an adhesive supply unit. This is a heated tank where the polymer is melted, filtered and pumped. The adhesive supply unit also contains all of the controls for the entire system. The PLC based control system is used to control all process variables. The second element to all hot melt systems is a heated hose to maintain the proper temperature of the polymer from point A to point B. The third and most important element is the type of applicator for the hot melt polymer. There are various applicators such as bead nozzles, slot dies, and spray type heads. The area that we will concentrate on today is a newer technology called UFD. This stands for unitized fiber deposition. Essentially we are producing monofilament fibers out of the polymer and using superheated air to control the laydown of those fibers. The design of this type of head is multifaceted. Each head section has two inputs one for shop air and the other for the hot melt polymer. The UFD applicator heads can be configured to operate based on specific back head pressure or provide a metered output. The difference is where the precision gear pumps are placed-either

inside the Adhesive supply unit or in the applicator head itself. Location of the precision gear pumps will determine the overall accuracy of the system. A metered output will be more accurate with the gear pumps placed directly in the head. A cross-web coat weight accuracy can be as accurate as 1%.The overall applicator head is modular in that it is made up of several sections to produce the final overall head size the width of the Web. The width extremes extend from coating an individual yarn or strand to applicator heads to 18’ in width. Each head section will be made up of its own internal filtration system, and air inlet, polymer inlet, and a bank of modules that can be individually controlled, and the final component- the nozzles. The nozzles are made up of laminated stainless steel plates that have been laser cut and are used to direct the airstream as well as the polymer stream to the individual orifice openings. There are literally hundreds of different types of nozzle designs depending upon the type of pattern that we are trying to accomplish. And there are nozzle designs that can produce monofilament's less than .001” in diameter. Nozzle designs can be configured to produce a single row of monofilament streams or double rows. A nozzle design can have a single output orifice or as many as 28 orifices out of a single nozzle. The two general patterns that are the result of this type of head design is what is called a random pattern or organized patterns called Omega patterns. It is very important here to note that the pattern density and the coat weight are totally controllable and is a repeatable process with the utmost in accuracy. Pattern design can be controlled by adjusting air pressure, adjusting pump pressure, adjusting line speed, and adjusting nozzle type. Coat weight can also be controlled by adjusting the same variables. Air curtain nozzles can be added to provide very sharp edge control. Solenoids can mounted in one inch increments to allow you to change web width on the fly by using the PLC to turn the solenoids on and off. In addition to variable coat weight capabilities, the coat weight can actually vary along the width of the web in a very controlled condition. For example, let’s say you would prefer to have a heavier coat weight on the outer edges than in the middle. This is very easily controllable via pump layout design and PLC controls.

Speed is another benefit to this type of technology. Because of the non contact design, coating and laminating can be run at speeds exceeding 2500FPM. This far exceeds the speed of other more conventional methods such as roll coating, scatter coating, and flame laminating. It is important to know that it is just

as effective at slower speeds as well. There are many systems out there running at 100FPM or less.

Through the use of a computer called a pattern controller, some additional very important features can be added to the UFD system. The pattern controller can receive impulses off of an encoder tied to the main web handling system and can compensate for any web speed variances and automatically adjust the pumps to keep the coat weight the same regardless of the variance in web speed. The same pattern controller can turn on and off the polymer patterns to purposely provide blank spots or strips if that be so desired.

The single greatest benefit to the UFD type technology for polymer laydown is savings in polymer or adhesive. The fiberized patterns can in most cases provide a lamination with nearly the same pull strength and the same shear strength but utilizing as much as 50% less adhesive. This is a paradigm shift to traditional methods to do film coating with roll type coaters.

Overall the UFD technology is designed to be a less expensive methodology for coating and laminating substrates while providing the maximum flexibility for your ever changing needs. This technology does not require drying ovens or chillers. In addition this technology allows you to produce products never before possible. The use of this technology is only limited by your imagination.