

Lower the Weight Of Your Film and Nonwoven Materials Through Adhesive Application Management

systems can save on raw material and non-material costs alike

Michael Fornes, market development manager, Nonwovens & Web Coating, Nordson Corporation

With today's steadily climbing oil prices and increased focus on green or sustainable strategies, disposable hygiene product manufacturers would benefit significantly by lowering the weights of their oil-based film and nonwoven materials. Not only can manufacturers save on raw material usage, but also overall shipping costs, which can make up 60-70% of the non-material product cost. However, many manufacturers are overlooking a strategic way to achieve this goal and reap considerable cost savings—adhesive application.

Much of the time, the limiting factor preventing manufacturers from using lower weight materials, including polypropylene and polyethylene is the adhesive applications the films must endure. One opportunity to reduce weight is to change the adhesive itself: some adhesives offer lower application temperatures or provide better bond strength, allowing lower adhesive add-ons to be used. Another key and often overlooked opportunity exists that can reduce weights—and costs—for all manufacturers.

Auditing your adhesive application equipment can reveal immediate, productive opportunities for film weight

reduction. The two main strategies for adhesive application auditing are add-on variation management and application technology optimization.

Variation Management: Saving Money in Unexpected Ways

By managing variation, producers minimize burn-through, a problem with film, and bleed-through, a problem with nonwoven material, thus allowing the use of lower-cost, lower-weight materials, which are also more sustainable, environmentally-conscious choices.

Typically, when manufacturers consider managing adhesive application they only look at adhesive usage. However, diapers are an example that reveals the truth about this strategy: adhesive usage only affects 3-7% of the total diaper cost. But the cost of the film and nonwoven material makes up 30-40% of the total cost of a diaper. So, by using adhesive application equipment to enable reduction in film weight, you can decrease the total cost of a baby diaper by a much greater percentage.



The image above illustrates the idea behind variation management. The orange line represents the required amount of adhesive add-on, or the minimum amount of adhesive needed to achieve the required function, typically bond strength or creep resistance. If producers have high variation (blue line), they have to set their average output so that any of their valleys aren't lower than that orange line. Due to the high amplitude, the average adhesive add-on set point must be high.

The peaks represent maximum add-on and can also represent the minimum adhesive temperature and open time the web materials must endure. When the variation is much smaller, a situation producers can create through effective variation management, they can set a much lower average add-on with much lower peaks that your web materials must endure. Less add-on allows you to use lower-cost, lower-weight film or nonwoven materials.

Two sources of variation exist: ramp-up and steady-state variation. Ramp-up variation occurs when the adhesive application system has to catch up with the line speed as producers ramp-up from a line slow-down or stop. This

is typically the overriding variation that must be addressed through higher add-on rates in order to ensure that the minimum amount of glue is applied.

Not only is additional adhesive add-on causing manufacturers to use higher weight materials, the duration of the ramp-up variation also represents a significant area of waste. In order to ensure that adhesive application pressure has returned to its steady-state level, manufacturers typically have to run their lines for a certain amount of "cull time" after a slow-down or downtime. During this period, the imperfect product is thrown away. To illustrate the waste this creates, on a line that produces 1000 diapers per minute, a cull-time of 20 sec means throwing out 333 diapers. Now multiply that by the number of times producers have to slow or stop their lines per day. One can spend more than \$100,000 per year just in culled waste.

Steady-state variation refers to the variation of the adhesive add-on when a line is running full speed. This is typically due to cross-web distribution of the adhesive being dispensed from a multimodule applicator or the pressure fluctuation due to adhesive compressibility and hose expandability for single module adhesive applicators.



Variation Management Application Equipment Options

For different adhesive application set-ups, you have different overriding scenarios. Typically on disposable hygiene lines, a long hose—which can expand and contract with pressurized compressible adhesive inside it—connects the adhesive melter to the applicator. In this setup, the overriding or

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most significant variation is the ramp-up variation, which typically runs at plus or minus 30% compared to the average steady-state variation, which is 10-15%.

Ramp-up Pressure Management

The first solution is to use the pressure build-up function in the hotmelt melter to maintain a minimum glue pressure in the adhesive applicator during shutdown or slowdown times. In a normal shutdown, everything, including pumps and motors, shuts off. In this set-up, pressure in the adhesive system is tied to the speed of the entire system, which sometimes can be zero if the line is stopped. That's when pressure begins to bleed back into the hotmelt melter.

Line speeds can ramp up faster than the pressure in the adhesive system can reach steady-state. Therefore, maintaining adhesive pressure near steady-state condition brings the adhesive ramp-up duration in line with the rest of the web ramp-up.

The typical savings for this option tends to be within the range of 5-10%. While this option is the least expensive to implement, not all hot melt equipment control systems include this capability.

Remote Metering Stations

Another option for managing variation is to install a remote metering station—a variable speed motor-driven gear pump outside of the hot melt melter, close to the adhesive applicator. Because the remote metering station is much smaller than the melter, it can be mounted closer to the point of application, overcoming the problem of long melter-to-applicator hose length.

A remote metering station can help overcome the

problem of ramp-up variation so that it is no longer the overriding source of variation that must be addressed, lowering your average add-on by 10-20%.

With single module applicators, which have no cross-web distribution variation, these savings are completely realized. In multi-module applications, producers can bring their variation to a level that's typically below cross-web, or steady-state, variation.

Because of the need for additional equipment—pumps, motors, motor drives and temperature channels—this solution represents an increase in investment. But with such significant waste and cost reduction potential, it's an investment that can be quickly recouped.

Metering Applicator

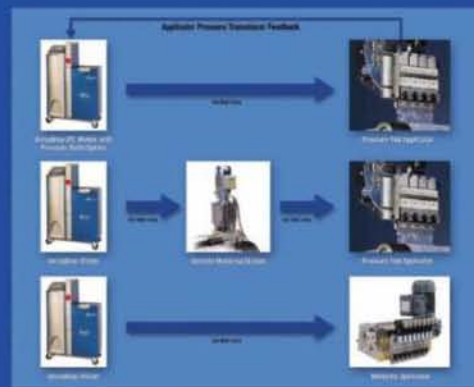
The first two options deal with managing ramp-up variation, which is the overriding variation of a more traditional system. But a third option involves not simply moving gear pumps closer to the applicator but inside it.

A metering applicator with an individual gear pump for each module and optimized temperature control reduces ramp-up variation and cross-web distribution variation to under 5% typically. This solution results in an approximately 25% reduction in adhesive add-on.

Upgrading to a metering applicator is an additional step up in sophistication and investment; however, this solution represents the greatest costs savings as justification.

As raw material costs increase and line speeds become faster, the need for better process control through adhesive variation management will continue to grow. This is not the final word in variation management, only the most current

Variation Management Options



one. Additional variation management technologies are continuing to be developed all the time. Producers should check with their adhesive application technology provider for the most cutting-edge solutions.

Optimizing Application Technology

Optimizing the application technology offers another opportunity to reduce film and nonwoven substrate weights. A few considerations can help you get started:

Peak bond strength vs. standard deviation: Peak bond strength is not the best measure of adhesive effectiveness; bond strength variation and peak bond strength must be considered together in order to realize savings.

Some technologies tout a high peak bond strength, but just because they have high peak bond doesn't mean they have enough of these peak bond points to maintain the bond strength required. If producers have to apply more adhesive to maintain the required bond strength, they aren't realizing savings in either their adhesive usage or their film weights.

Breathable lamination considerations: Both contact and non-contact technologies exist that can provide breathability, but some require a higher add-on weight than others. Some use repeating spray pattern technologies to achieve breathability, which affect the feel and often require higher add-on rates. Consider instead the industry standard, a contact random pattern technology that allows for lower adhesive add-on and a more comfortable product. Contact applicators can be easily retracted during line

stoppages. Their add-on reductions can then facilitate using lower weight substrates than spray applications.

Elastic considerations: Elastic coating is a critical part of the diaper manufacturing process, since elastic features, to a large extent, define the fit of the product to the user. Too-tight or too-loose elastic can hurt product performance and customer satisfaction. Multi-strand elastic coating accommodates all types of elastic configurations, but it also uses the most adhesive and can result in elastic creep. Individualized strand coating technologies—particularly ones that use an integral elastic guide in the applicator nozzle to ensure that each strand is adequately coated with minimum adhesive add-on—are a cost-saving option.

Universal systems: To position the manufacturing line for continual, maximum variation management efficiency, consider moving to more universal platforms. Not only do universal systems simplify the process of changing nozzles as part of a good preventative maintenance program, they also mean producers can upgrade easily—and without replacing the entire applicator—as new technologies become available.

Getting Started

Many people overlook this opportunity to bolster profits even as the cost of materials continues to rise. Get started by taking a strategic look at

- Adhesive choices
- Variation management
- Optimization of application technology

Because every line is unique, it can be a challenge to determine what strategy would be the most effective for each operation. A good way to get started is with a tool that analyzes the savings producers can achieve by moving to lower basis weight substrates based on material usage. Below is just such a tool: go to this calculator to plug in your operation's parameters to see your potential savings. Then consult your adhesive equipment supplier to help you evaluate how low you can go. ♦

For more information on Nordson adhesives systems, contact www.nordson.com.