

Emerging Applications of Atmospheric Plasma Treatment (APT) for Non-Wovens

Many of the consumer products that already are highly penetrated in the mature markets of North America, Western Europe and Japan continue to generate growth for nonwovens by

expanding their functionality.

The functional performance and value of nonwoven components continue to progress.

Representative of this growth, the 2004 worldwide production of nonwoven roll goods was expected to be 4.5 million tons, equivalent to 110 billion square meters, and valued at US\$16 billion. Rising at an average annual growth rate (AAGR) 7.5%, the market is expected to reach 5.75 billion pounds in 2009. We have seen an explosion of new consumer applications for nonwovens. Examples include:

- Household cleaning wipes
- At-home dry cleaning kits
- Facial cleansing cloths
- Pre-moistened roll wipes
- Floor cleaning cloths
- Fabric refreshing kits
- Facial pore strips
- Body cleansing wipes

The new nonwoven products are fueling growth in previously low-growth, reusable product categories by substituting reusable products with new disposable product concepts, as well as adding value-adding graphics to these products.

Manufacturers looking to join the specialty markets are looking for ways to differentiate themselves in a vast sea of competitors. One of the best ways to do this is to enter a

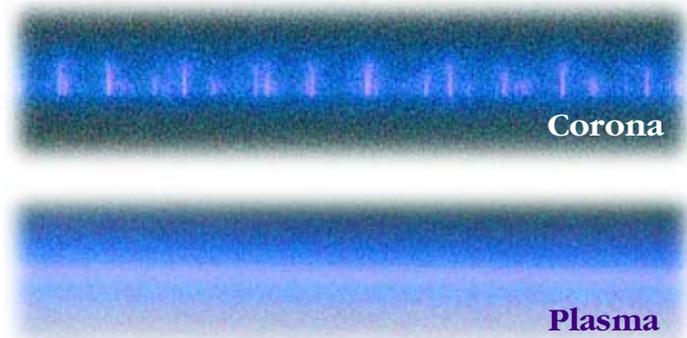


Plasma3™ provides unique and effective treatment in atmosphere using proprietary gas chemistries.

variety of specialty-based markets with processing capabilities which offer unique and attention-grabbing product features.

Textile companies with extensive knowledge of printing on nonwovens are investing in APT technology to produce a range of spunbond and needlepunch materials which carry added-value designs. Why? Because APT improves fiber surface properties such as hydrophilicity without affecting the bulk properties of these fibers. It can be used by Textile manufacturers and converters alike to improve the surface properties of natural and synthetic fibers to improve adhesion, wettability, printability, dyeability, as well as to reduce material shrinkage. Fibers with polar functional groups can be dyed more easily than non-polar fibers since polar groups will chemically bond with dye molecules. Because the molecular chains of nonwoven substrates such as polypropylene are non-polar and its surface is hydrophobic, the ink and dye molecules will not chemically bond to the fibers. These fibers can also be highly crystalline, which also restricts its pigmentation.

APT technology provides treatment of nonwoven substrates at low temperature while operating at atmospheric pressure. The wettability of various synthetic and natural fibers has been dramatically increased by this process. Electron microscopy has shown that the surfaces of fibers after atmospheric plasma treatment are clean, uniform and consistent, confirming that APT is homogeneous.



The APT process has the following attributes relative to the surface treatment of nonwovens:

- **Produces uniform and homogenous plasma at atmospheric pressure and low temperatures**
- **A variety of process gases can be used which envelops and functionalizes fiber structures**
- **Enhances surface energy thereby improving wettability, printability and adhesion**
- **No backside treatment**
- **No need of vacuum chamber and pumps**
- **Available for most web widths**
- **Rugged construction**
- **Fully electronic process control with indicators**

Printing processes which have benefited from the integration of the APT process and its deposition of functional chemical groups include direct pigment printing (flexo and solvent-based systems), rotary screen, and digital ink-jet.

Major global consumer product marketers clearly consider new, value-added nonwoven consumer products to be crucial to corporate growth and hence have made extensive use of Enercon's 60" wide APT pilot line for trials of nonwoven roll goods. By developing and protecting sources of enduring differentiation in nonwoven performance and aesthetic properties using technologies like APT, nonwoven manufacturers can earn and hold value in the emerging value chains for these significant new consumer products.

Is Atmospheric Plasma Right for My Non-Woven Application?

Enercon's surface treating laboratory can help you answer this question. Our lab serves as a breeding ground for product and application innovation. We share this research facility with our customers as partners in their product development plans. The laboratory serves as a confidential process development center where customers can trial a variety of web surface treating technologies including atmospheric plasma, corona and flame.

By offering a broad range of treatment options our customers have an opportunity to compare technologies with complete, accurate and unbiased test data. This test data yields valuable insight into the most effective process for a given application.

In addition to our laboratory in Menomonee Falls, Wisconsin

we also have atmospheric plasma trialing capabilities set-up in our European and Asian offices. To set-up an application trial for your non-woven or other roll goods products contact us at **262-255-6070**.



For more information please contact:
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