Meltspun Nonwoven Systems

FIBRE EXTRUSION TECHNOLOGY

"Innovative Fibre Solutions"

Meltspun Nonwoven Systems

1. INTRODUCTION

FET has a proud history of R&D and innovation. We are driven by the mission to help our customers find solutions to specific technical problems, but frequently we find that this research has applications outside the initial remit. This was the case with our meltblown and spunbond systems originally developed for the medical market.

- Laboratory, Pilot and Small Batch Meltblown and Spunbond production systems - FET's core strengths and markets
- Development of special technology which allows processing of high melt viscosity polymers
- An extensive range of nonwoven end product specifications
- Originally this new technology was developed for use with medical grade resorbable polymers, which have high melt viscosity and high value

This new meltblown and spunbond technology is also very useful for other non-medical applications. In particular, it can process other high viscosity polymers, giving opportunities for new high value and niche applications. *(See Appendix 1)*

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Meltblown Nonwoven Systems

2. WHAT IS MELTBLOWN TECHNOLOGY?

Meltblown systems use a one-step process in which high-velocity air blows a molten thermoplastic resin from an extruder die on to a conveyor to form a fine fibrous and self-bonding web. The fibres in the meltblown web are laid together by a combination of entanglement and cohesive sticking. The ability to form a web directly from a molten polymer without controlled stretching gives meltblown technology a distinct cost advantage over other systems.

Key benefits of FET Meltblown systems

As a result of innovative development work by FET, nonwoven structures can now be readily made from "difficult to process" polymers. The new processing technology is a unique adaptation of the meltblowing process and makes possible the conversion of a wide range of polymers into nonwoven webs, using a single processing stage.

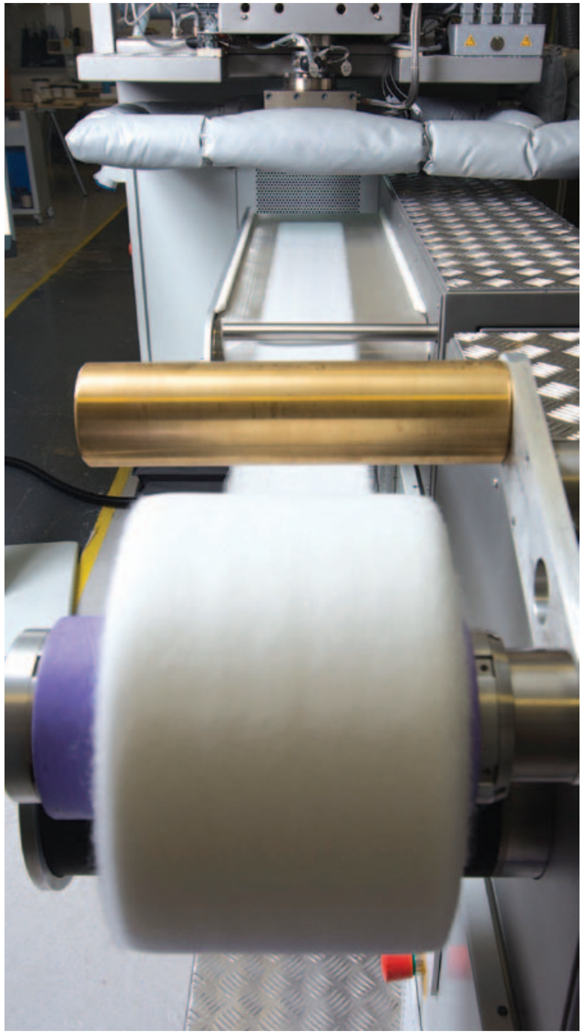
For many of our clients, the benefits of single stage manufacturing and the flexibility provided solve many processing problems and give them a substantial competitive edge.

Meltblown Nonwoven Systems

New processes have been developed in particular for polymers that have properties which would in normal circumstances make them unsuitable for meltblowing, such as high melt viscosity or susceptibility to degradation. These versatile systems enable the extrusion of meltblown nonwovens with a broad span of structures and mechanical properties, including:

- Bio-medical applications using resorbable polymers
- Those required for filtration and niche applications
- Structures which exploit polymer properties such as thermal and chemical resistance

Meltblown webs offer a wide range of product characteristics such as random fibre orientation, low to moderate web strength. About 40% of meltblown material is used in the uncombined (monolithic) state. The remainder of meltblown materials are composites or laminates of meltblown webs with another material or nonwoven. The largest end-uses for monolithic meltblown materials are oilsorbents, air and liquid filtration media.



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Spunbond Nonwoven Systems

3. WHAT ARE SPUNBOND SYSTEMS?

Although the processes are very similar, the key physical difference between the spunbond and meltblowing process is in the die assembly. In the meltblown process, hot air converges with the fibre as it emerges from the die, whereas in the spunbond process the hot air is at a cross flow to the emerging fibre. The result is that spunbond webs contain courser fibres which are stronger and less bulky than their meltspun counterparts.

Benefits of Spunbond technology

These properties of Spunbond nonwovens provide a number of benefits:

- Absorbency, washability and liquid repellence
- Softness, cushioning and strength
- Bacterial barrier and sterility
- Resilience and stretch

Spunbond nonwovens are widely utilised by various industries, especially the medical, personal care and hygiene sectors, as an affordable disposable alternative to traditional textiles.

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Composite Nonwoven Systems

4. COMPOSITE SYSTEMS

As described above, meltblown and spunbond have different diameter filaments and other property variations. When the two processes are combined, this allows a multitude of technical benefits to be achieved.

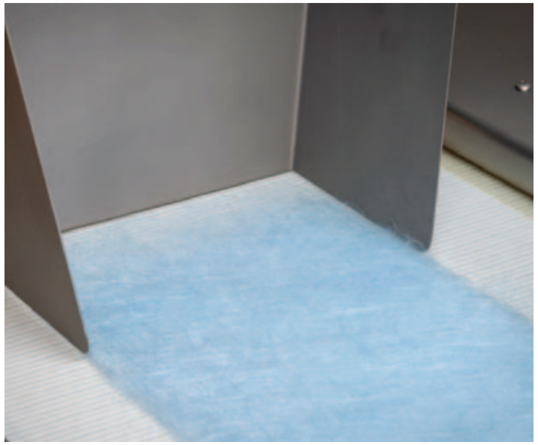
Meltblown / Spunbond multilayer fabrics include SM (spunbond-meltblown) and SMS (spunbond-meltblown-spunbond), which are frequently used in filtration applications.

SMS is a tri-laminate nonwoven fabric. It is made up of a top layer of spunbond polypropylene, a middle layer of meltblown polypropylene and a bottom layer of spunbond polypropylene. Multi-denier spinning allows for the combination of these spunbond and melt blown materials into a single nonwoven web. This web is then pre-bonded and passed through calendar rollers for thermal bonding.

There is further potential for multiple combinations of meltspun and spunbond materials, such as SMMS, SSMMS and SMMMS.

Composite Nonwoven Systems

Other variations and benefits



Bi-component continuous filaments that consist of more than one polymer type arranged in different configurations within the filament cross section (eg, side-by-side, core-sheath, segmented pie, and islands in the sea) can be utilised to produce nonwoven fabrics containing microfibres and sub-microfibres by splitting or fibrillating the filaments in the web after it has been extruded. Meltblown fabrics are frequently combined with nanofiber webs to achieve greater filtration efficiency.

Composite nonwovens have the advantage of flexibility to bond with other types of webs, resisting shedding, with relatively higher mechanical strength, and are stable and resilient. They also have the advantage of forming functional fibres, such as antibacterial, and receiving permanent treatment (eg, flame retardancy) at the fibre extrusion stage.

FET's composite nonwoven systems are proven to provide solutions for nonwovens manufacturers and research establishments globally.

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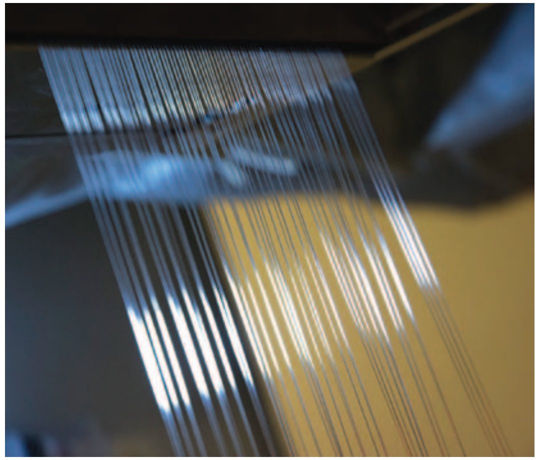
5. A COMPREHENSIVE SERVICE

The scope and potential of meltblown and spunbond systems for nonwovens is therefore substantial, particularly for niche applications typically of low volume but high value production. Pilot systems are available and at your disposal in FET's own Fibre Development Centre for your trials and product development requirements.

All FET customers are provided with a full back-up service. Equipment and ancillary products are supplied as a turn-key installation, complete with commissioning and training. Ongoing support is maintained via on-line modem connection, providing remote diagnostics and technical support. FET's in-house Fibre Development Centre is available for help and advice at all times.

6. SUMMARY OF THE PROCESS

- Applicable to a broad range of polymers, including those normally considered as not appropriate for the melt blowing process.
- Applications include resorbable biomedical polymers, but also numerous industrial grade materials.
- The pure polymer is processed with no requirement for processing aids or additives.
- A wide range of structural and mechanical properties are obtainable from the process.
- There are numerous options for post-processing of the web, such as by calendaring, point bonding or lamination.



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APPENDIX

Wide range of Polymers

	Meltspun Nonwovens
Polyolefins Polypropylene Polyethylene PO co-polymers	✓
Resorbable Polymers (Biomedical) PGA Polyglycolic acid PLLA Polylactic acid PHB Polyhydroxy butyrate PTMC Poly trimethylene carbonate PCL Polycaprolactone PDO Polydioxanone	✓
Performance Polymers PET Polyethylene terephthalate PBT Polybutylene terephthalate PA Polyamide TPU Polyurethanes TPE Thermoplastic elastomers	✓
Sustainable resins S-Polyamides PLA, PDLA PHA Polyhydroxy alkanoate S-PET	✓
Engineering Polymers PPS Polyphenylene sulphide PPSU Polyphenylsulphone PEI Polyetherimide PEEK Polyetherether ketone ABS Acrylonitrile butadiene styrene PC Polycarbonate	✓
Halogenated Polymers PVdC Polyvinyledene chloride CTFE Chlorotetraflouroethylene	✓

APPENDIX
A wide range of Nonwoven Structures and types

Numerous polymers and structures have been tested and there is considerable potential for a wide range of other nonwoven applications of this process. Resorbable polymers processed to date include PLLA, PGA, PLGA and P(G-TMC) together with other polymers like PP, PET and PBT.

We can create a variety of structures and types which satisfy technical demands on porosity, density, thickness and so forth:

- Filament diameters from < 2ì to > 30ì (equivalent to <0.04 denier to > 8 denier)
- Thickness from 0.1mm to >20mm
- Density from 20mg/ml to >250mg/ml
- Thickness and Density can be varied independently for most polymer

Specifically, when researching how to process finer filaments, we achieved the following structures:

Filament diameters

Mean: 1.68 microns (58%: 0.5 to 1.5 microns)

Web

- Thickness: 37 microns
- Bulk density: 98 mg/ml
- Porosity: ~92%

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CELEBRATING 25 YEARS