FET Fibre Development Centre (FDC):

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FET Fibre Development Centre

Following a massive investment programme, FET completed construction and fit-out of its new purpose-built Fibre Development Centre (FDC) in 2023.

This modern two-storey development provides state-of-the-art facilities and the resident equipment reflects the wide range of fibre extrusion systems offered by FET to clients across the globe, enabling continued growth of the company through innovation.

Clients frequently spend several days on site participating in development trials and technical sales meetings, so the new Centre is designed to make their stay even more efficient and comfortable.

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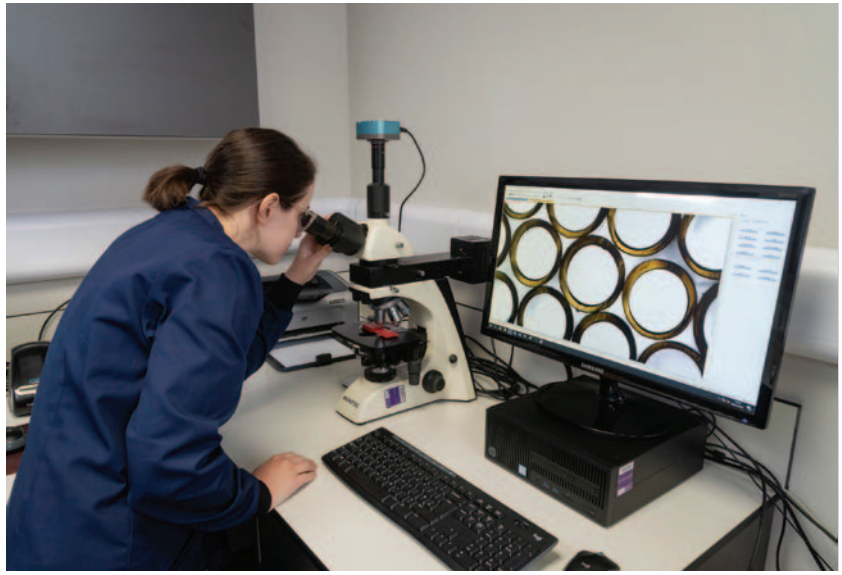
Our customers believe strongly in the importance of R&D and innovation and FET shares this conviction.

It is our policy to meet your scientific and production requirements and work closely with you to find optimum solutions. We constantly review our product portfolio and extend our range of services when the need arises. This is the reason we attach so much importance to our Fibre Development Centre.

1. LABORATORY APPLICATIONS

The FET in-house laboratory facility is a vital element of our service, enabling a high level of equipment and process development for our customers. Installed in this facility is a complete range of pilot extrusion lines capable of facilitating all aspects of research and development.

All resources are put at your disposal to allow complete freedom of testing, evaluation and development to maximise the prospects of a successful outcome. Our qualified extrusion process technologists are fully available to work closely with you to advise, plan and execute the trials. Customers can utilise the laboratory facility on a daily basis.



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The FDC has been used by customers for a wide range of product development projects. The following Melt Spinning pilot line facilities include:

Multifilament

- Equipment: Uni-component or bi-component, single screw extruders, metering pump, air cooling, spin finish application, 5 sets of heated rollers for draw & relaxation
- Bi-component: core/sheath, side by side, side by side by side

Monofilament

- Equipment: Uni-component or bi-component, single screw extruders, metering pump, air cooling, water quench, heated zones (water, air, IR, hot plate)
- Bi-component: core/sheath

Melt blown

Available soon, meltblown nonwovens system.

Coming soon - **Wet spinning and gel spinning** systems will be available in late 2023. Where melt spinning solutions cannot succeed, FET provides a viable alternative with pilot scale Wet Spinning Systems, which may be used for a variety of solvent and polymer combinations:

Test facilities:

- Linear Density (Titre)
- Tensile testing
- Melt flow index (MFI)
- Moisture content (Karl Fischer)

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2. A FLEXIBLE APPROACH TO MEET THE CLIENT'S NEEDS

It is in the nature of our business to encounter an enormous variety of requests from our customers and we rarely fail in finding a solution. Our Fibre Development Centre plays a key part in the successful resolution of such challenges:

- Process and product development
- Proof of concept testing
- Sampling and prototyping
- Textile material engineering
- Collaborative research
- Testing and evaluation of polymers & additives
- Risk testing and elimination

A global market

We have clients in over 35 different countries throughout Europe, Asia, Africa, Australasia and the Americas and many have used the facilities available in the Fibre Development Centre.

We understand the importance of building up close relationships with different individuals, intermediaries and cultures, and can provide global reference installation sites. We deal on a regular basis with customers on all levels of responsibility, from CEO's to General Managers, Business Development Managers, Project Managers, Product Development, laboratory and research & development personnel. As a result of this flexible, customer-driven approach, a high proportion of our client base is represented by repeat order business over many years.

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Typical examples materials tested at the Fibre Development Centre

- Biomedical materials, such as resorbable polymers for use in medical devices
- Specialized novel fibres from exotic and difficult to process polymers
- Sustainable polymers, biodegradable and composting materials
- Textiles for a wide range of composites
- Functional textile materials, provided by polymer formulation or additives
- Non-woven materials from viscous polymers

3. SECURITY AND CONFIDENTIALITY

All customer projects are of course treated in the strictest confidence and a high level of security remains in operation at all times. FET attaches the same level of importance to confidentiality as even the most security-conscious of our customers would expect.

Clients can make arrangements to book exclusive lab time for their own technical and managerial personnel in an enclosed environment. This can be anything from one day to a week or more, on a rolling basis if this is what you require. FET technical staff will be on hand to assist or play a leading role in research, according to your wishes.

We are unable to give specific, in depth information about process laboratory case studies, due to confidentiality and non-disclosure agreements, but the diversity of our experience is truly impressive. The following example provides a flavour of the type of project we are often involved in.

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Case Study 1

RESORBABLE NONWOVENS FOR A MEDICAL DEVICE MANUFACTURER

A leading medical device manufacturer (MDM) was interested in applying the benefits of FET's meltblowing technology to produce new materials and products using their existing range of bioresorbable polymers.

The FET non-woven processing system was an in-house development, specifically designed to process high melt viscosity polymers, especially resorbable biomedical polymers, which are susceptible to degradation during processing. This case study provides an example of the Research Team at FET working closely with the MDM Project Team to provide a rapid and low risk route to complete the product development and achieve manufacturing capability.

Stage 1: Proof of capability

The first step was for FET to use the in-house melt blowing pilot line to run a Proof of Capability trial. This three day trial successfully demonstrated that the FET system could use one of their resins to produce a nonwoven web that matched their target structure.

Stage 2: Initial sample evaluation

A detailed confidentiality agreement was put in place and the MDM supplied a range of their polymers for further processing trials. These were attended by MDM staff who worked with FET to produce a range of samples with different structures and compositions. Each resin had different processing properties and the equipment configuration and processing conditions needed to be adapted for each one. Samples were provided for evaluation by the MDM along with a detailed report of the processing properties of each polymer formulation, allowing the MDM to select the best polymer for further work.

Stage 3: Lead option trials

The third stage was carried out on the lead option polymer, comprising a series of short trials to produce samples with different structures and properties. This also provided the opportunity for FET to refine the equipment design and processing conditions for the selected polymer and discover how to gain tight control over the filament and web formation processes. Modifications were made to the design of the spinneret and air blades, which improved the structure and consistency of the web. This iterative process lead to the specification of the preferred polymer formulation and web structure, generating the scale up data that was required to design and specify the production unit.

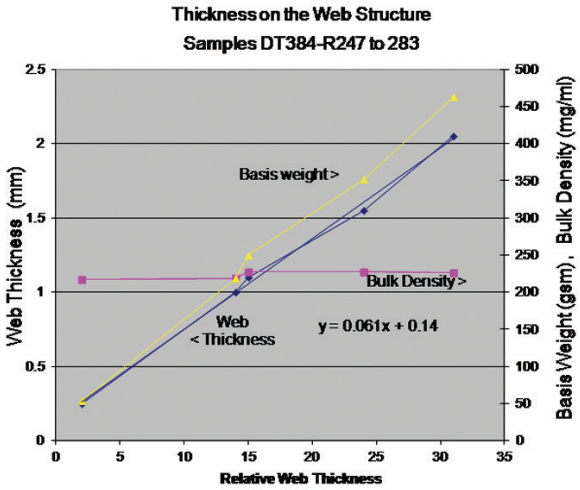
Step 4: Build and ongoing testing

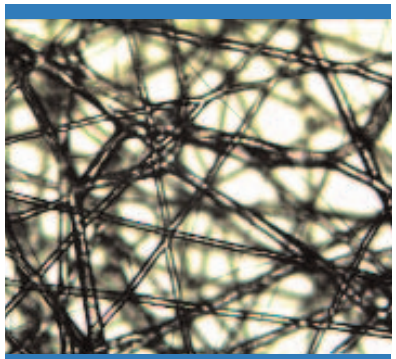
Whilst the Production Line was being built, the progress of the MDM's project was accelerated by FET producing batches of the specified nonwoven for the customer to continue trials and testing of their prototype product. The nonwovens were made to an agreed SOP covering all aspects of the machine preparation, sample production and data recording.

Stage 5: Verification and training

In the final stage, the R&D staff at FET helped the MDM complete a rigorous verification of the processing systems on the new production line and provided detailed training for the new operators.

Example of output from processing trials to investigating control of web structure





Micrograph of the web structure

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Case Study 2

HIGH TENACITY LOW DENIER PET FIBRE

FET was approached by a medical device manufacturer with the request to provide fibres for the development of a new product. They required a high tenacity PET mutifilament but at a very low denier.

Introduction

HT-PET fibres are now available from specialist processors at round 6 dtex per filament for applications such as tyre cord. However as the filaments become finer it becomes much more difficult to maintain these high tenacities. To achieve the target of below 2 dpf is a substantial challenge.

Trials at FET drew on experience of processing very high strength yarns for resorbable sutures. For PGA yarns (poly glycolicacid), FET has already developed the processing technologies that make it possible to routinely attain tenacities above 10gpd. This was based on specific optimisations of:

- Polymer resin formulation
- Equipment design and specification
- Processing conditions and techniques

This provided a good starting point for the project which progressed through the following stages:

Stage 1

A preliminary trial was able to demonstrate that the tenacities double their current yarn could be achieved but this still left a 30% shortfall from their target.

Stage 2

In the second phase FET approached a series of resin manufacturers and solid state polymerization contractors in Europe and America with the aim of identifying a suitable grade of PET for this application. Trials on these resins closed the gap to around 15% shortfall but revealed that some upgrading to the FET pilot line was required to progress further.

Stage 3

Whilst the equipment upgrades were being implemented, FET arranged for a programme of trials to be carried out at a European based textile research institute. This organization had extensive experience of processing HT-PET and a high specification FET melt spinning line. Unfortunately on this occasion they were unable to achieve any further improvement in the yarn properties and the project returned to the FET pilot line.

Stage 4

Trials returned to the FET pilot line now upgraded with refinements to the spinpack and upgrades to increase the number and temperature range of the drawcabinet. These trials were successful in attaining the targets for high tenacity and low denier, but process reliability was poor with frequent stoppages for yarn breaks.

Stage 5

A further 2 rounds of trials were required to understand the causes of these breakdowns and to implement incremental improvements that involved aspects of the resin formulation, equipment design and processing conditions.

The final outcome was the capability of demonstrating the yarn that fully met all the targets being produced for a full day without breakdowns.

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APPENDIX

Grid showing types of polymer used in processing trials at FET

	Multifilament	Melt Spun Nonwoven	Monofilament
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	✓	✓	✓

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