



## Microcellular Extrusion Solutions

### Q What is the MuCELL Extrusion business model?

**A** MuCELL Extrusion licenses Intellectual Property and sells related equipment. Licensees obtain rights to the products they design and manufacture and gain a competitive advantage.




Licensees pay a royalty fee which is normally a percentage of their cost savings or a percentage of their sales.

MuCELL seeks to form close relationships with Microcellular Extrusion Solutions owners to provide the opportunity to extract maximum potential within their specialist business areas.

#### MuCELL Compatible Polymers

- Polyethylene
  - Polypropylene
  - PLA
  - PET
  - PVC
  - Polyurethanes
  - Polystyrene
  - Polycarbonate
  - ABS
  - Nylon
- And many more...

#### More Lighter, Greener, Lower Cost Applications

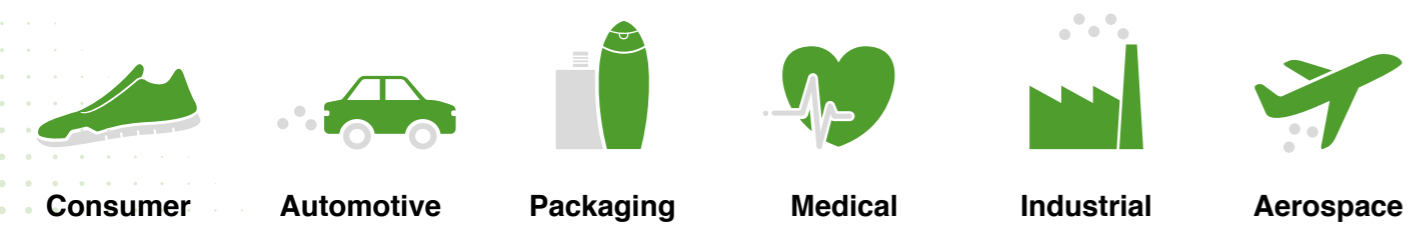
Process	Product
Film	Stand up pouch 
Sheet	Yoghurt pots 
Blow moulding	Motor oil bottles 



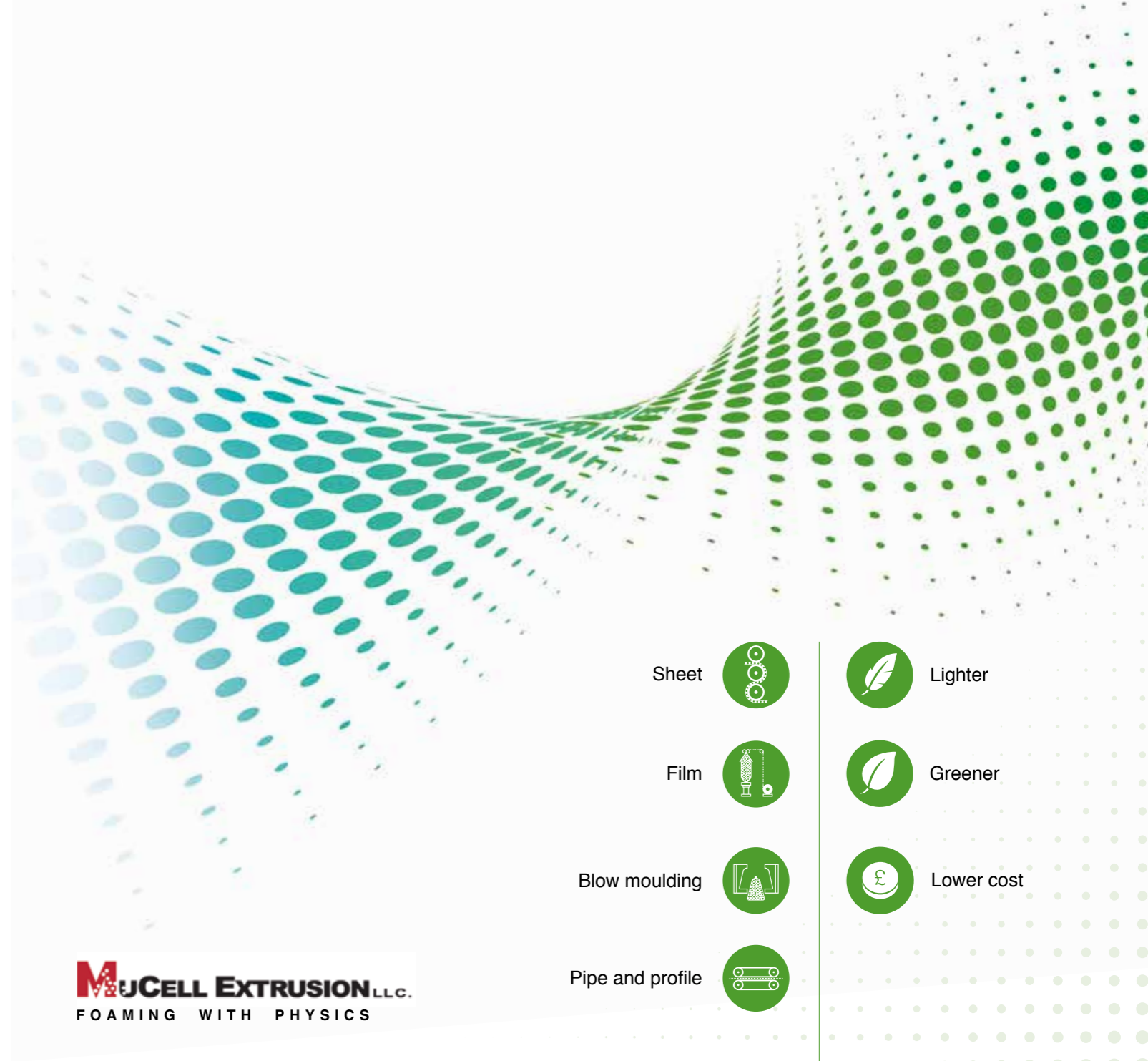
Call your extrusion partner to discuss your next MUCELL project








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# Microcellular Extrusion Solutions



- Sheet   Lighter
- Film   Greener
- Blow moulding   Lower cost
- Pipe and profile 



**Q What is MuCELL technology and how does it work?**

**A** MuCELL is a foam that performs like a solid plastic. MuCELL technology creates microbubbles in the centre of plastic extrusions by injecting gas into the melt as they are manufactured. The end user will not notice any change in the part as the MuCELL bubbles in the centre layer are so small that they are barely visible to the naked eye. The outside layers are often solid plastic. Pure atmospheric gases, nitrogen and carbon dioxide are the foaming agents which create the bubbles.



**Q Where can MuCELL technology be applied?**

**A** All extrusion applications, including packaging applications, ranging from large containers for products like motor oils or laundry detergent, to smaller packages for cosmetics and personal care.

Unilever is using MuCELL Microcellular Extrusion Solutions in its Dove body wash, generating substantial solid waste and greenhouse gas reductions. Coveris is using MuCELL to produce FFS sheet for food containers like yoghurt pots. Mondi is also using the technology in thin flexible packaging for products like wet wipes, pet care and detergent pouches.

MuCELL Extrusion films manufactured from Dow polymers were developed for many flexible packaging applications, to reduce the carbon footprint of the Rio Olympics. New industries and new applications are under development.



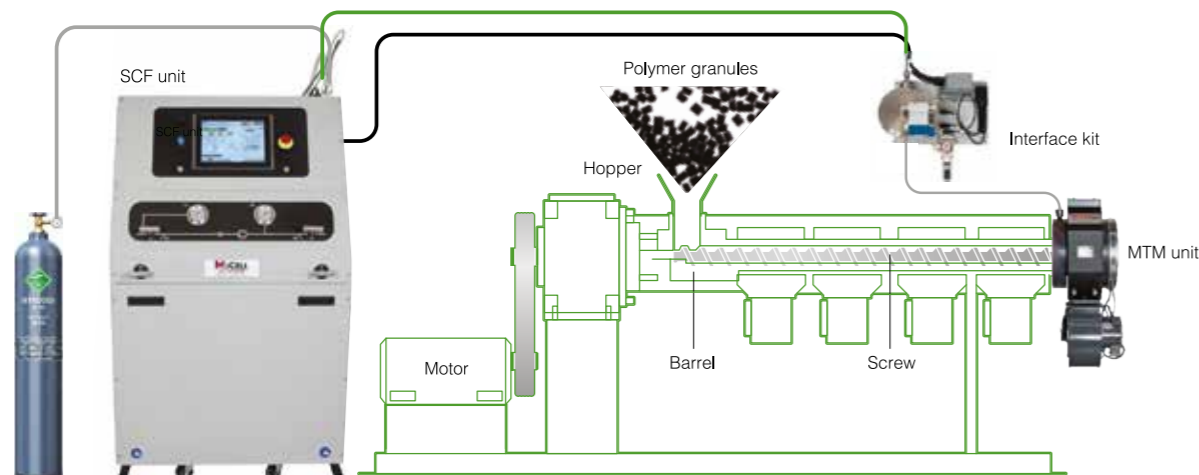
**Q What are the end use benefits of MuCELL technology?**

**A** The films and sheets produced by the technology are lighter, greener and cheaper than traditionally manufactured equivalents. Products manufactured using MuCELL Microcellular Extrusion Solutions typical need 15–20% less polymer than those using traditional extrusion technologies.

- Lighter
- Greener
- Lower cost

**Q How are MuCELL Microcellular Extrusion Solutions applied?**

**A** This technology fits seamlessly into all existing extrusion lines. There are three key components which transform the line into a microcellular one. These are the MuCELL SCF unit and Interface Kit, which pressurize, control and inject the gas in a Super Critical Fluid (SCF) state, the MTM barrel extension, which mixes polymers and gas in a single phase solution, and proprietary die design to optimize cell formation.



**Q Can MuCELL technology be applied to existing products?**

**A** MuCELL foaming can be applied to many existing products as well as being designed into new product development projects. The technique is suitable for most polymers and most extrusion products can benefit from the MuCELL microfoaming advantage.



**Q Which extrusion technologies are suitable for conversion to MuCELL technology?**

**A** The technology is suited to all extrusion processes including sheet, film, blow moulding and pipe and profile extrusion lines.

Sheet	Film	Blow mould	Pipe and profile
<p><b>Sheet applications:</b></p> <ul style="list-style-type: none"> <li>• Sheet for form fill seal (FFS) thermoforming</li> <li>• In-line thermoforming</li> <li>• HDFT</li> <li>• Sheet for signs and displays</li> <li>• Sheet for construction</li> <li>• Low density sheet for gaskets and seals</li> </ul>	<p><b>Film applications:</b></p> <ul style="list-style-type: none"> <li>• Lamination films</li> <li>• Stand up pouches</li> <li>• Collation shrink</li> <li>• Agriculture</li> <li>• Pet food bags</li> <li>• Surface protection</li> </ul>	<p><b>Blow moulding applications:</b></p> <ul style="list-style-type: none"> <li>• Single layer bottles</li> <li>• Multi layer bottles</li> <li>• Automotive duct work</li> <li>• Bulk liquid containers</li> <li>• Large structural parts</li> </ul>	<p><b>Pipe and profile applications:</b></p> <ul style="list-style-type: none"> <li>• Irrigation pipes and tubing</li> <li>• Profile seals</li> <li>• Plumbing</li> <li>• Landscape edging</li> <li>• Lumber replacement</li> <li>• Picture frames</li> </ul>

**Q What is the environmental benefit?**

**A** MuCELL has many positive environmental benefits over traditional techniques. As nothing but atmospheric gases are added to the foamed polymer, harmful emissions are avoided, recycling these pure materials is easy and cost effective. As the technology reduces plastics used at the source, its widespread adoption could significantly reduce the volume of oil derived plastics used. In addition to reduced plastic consumption and the point of manufacture, MuCELL delivers reduced fossil fuel usage as a result of the weight reduction derived from microfoaming of the finished parts.

**Q What is the story behind MuCELL technology extrusion?**

**A** MuCELL Extrusion LLC, based in Woburn just outside Boston USA, is owned and funded by Zotefoams plc, a UK based pioneer in global cellular materials technology company which is quoted on the London Stock Exchange. Zotefoams formed MuCELL Extrusion LLC to develop the intellectual property in 2008 and became 100% owner in 2011.

**Q What is the MuCELL approach to NPD?**

**A** The team MuCELL relish the opportunity to work side by side with customer development teams. The on site MuCELL laboratory creates the ideal test environment.