

Questions and Answers Regarding Trexel's Decision to Offer TecoCell®, a Chemical Foaming Agent to its Customers

Why is Trexel getting involved with a chemical foaming agent?

Trexel has long believed that chemical foaming agents (CFA's) could not produce a consistent microcellular structure needed for foaming thin wall parts because of their composition and the process whereby they produce blowing agent.

In the course of our research and development with Polyfil's EcoCell product line we were able to identify process conditions that indeed create generally consistent microcellular structures within certain parts and with specific materials.

This discovery now enables Trexel to offer multiple high performance foaming solutions to our customers depending on their exact requirements by combining Trexel's expertise in both designing and molding foamed parts with the superior performance of the TecoCell® chemical agent.

Why did Trexel partner with Polyfil?

The Polyfil product offering is unique in its composition. The TecoCell product has only one reaction temperature going straight to CO₂, water and citric salts as opposed to most endothermic foaming agents which have an intermediate harmful reaction product of soda ash causing plate out and corrosion. This provides for a cleaner process and a more consistent conversion to CO₂.

In addition, the TecoCell product is covered by patents regarding the particle size of the reaction products that result in a smaller cell size and a more uniform cell distribution. Combining the TecoCell patents with Trexel's patents on cell size and microcellular processing alleviates any possible overlap or intellectual property conflict for users of TecoCell.

Are MuCell and TecoCell directly competitive with one another?

Not at all. The applications for these two foaming technologies are really quite different in most cases. TecoCell will enlarge the field of microcellular applications into areas where MuCell has not represented an effective solution: (namely, low product volumes based on talc filled PP and PE, unfilled olefins, and automotive blow molding). As you will see below, there are quite clear economic and technical difference between the two systems beginning with the level of precision that each one offers, the gases that are used a blowing agents (CO₂ for TecoCell vs. Nitrogen for MuCell), the applicability for higher temperature materials such as Nylons, etc.

MuCell demand in the market is growing strongly. We think there is an equally strong market for a superior chemical foaming system such as TecoCell.

Why is Trexel using the TecoCell® product name?

Polyfil will continue to offer these products for the extrusion market under the EcoCell® trade name. In order to prevent confusion in the market regarding the markets serviced by Polyfil and those serviced by Trexel, Trexel chose to market the product under a different trade name.

Does a TecoCell user need a License from Trexel in order to produce injection molded parts?

Both Trexel and Polyfil, the inventor of the underlying chemical foaming technology, control strong patents with respect to key enabling features for the production of microcellular injection molded or blow molded parts. Any company which purchases the TecoCell foaming agent is granted automatic rights to make, use, and sell microcellular injection molded parts under Trexel's worldwide patent portfolio.

How does the MuCell foaming process differ from the EcoCell?

The MuCell process introduces either Nitrogen or CO₂ directly into the barrel of the injection molding machine. As no chemical reaction must occur to generate the supercritical fluid, barrel temperatures can be set at or lower than would normally be done for the material being processed conventionally. In addition, the MuCell Process requires a capital expenditure to modify injection molding equipment and to install a precision delivery system for the Nitrogen or Carbon Dioxide gas.

Once the MuCell capital investment is made, the Nitrogen (or CO₂) gas can be delivered at a very small incremental cost (typically less than \$0.01/part.) Furthermore, increased gas levels leading to increased levels of foaming do not result in increased operating costs for the producer. Any selected gas level can be precisely set and maintained within the MuCell Process with little to no variability.

TecoCell, which may be added at levels ranging from 1-3% involves relatively low capital investment but high annual operating costs. For example, a 2% additive level may result in an additional cost of \$0.06 (6 cents) per pound of end product produced.

TecoCell achievable foaming levels that result from the formation of Carbon Dioxide gas will be generally lower than foaming levels produced by the direct addition of Nitrogen gas through the MuCell Process.

Are the MuCell Process and TecoCell Chemical Foaming Agent Interchangeable?

No. Our research shows that TecoCell is superior for applications that involve the molding of unfilled polyolefins and other unfilled resins. MuCell is superior in reducing warpage and in achieving dimensional stability. MuCell is more suitable by far for high temperature resins. Both

systems are applicable to the foaming of talc-filled polypropylene with overall economic advantages determined by part thickness, part design and part volume.

The TecoCell product has a reaction temperature of 200 C (392 F). Materials that must process at lower melt temperatures would not be suitable for this product. (These would include high melt flow rate PP resins and some elastomeric materials.) TecoCell is an endothermic foaming agent which means that it produces CO₂. In general, CO₂ is a less powerful foaming agent than Nitrogen. As such, the MuCell Process is more effective in thin wall parts, less than 2 mm wall thickness. TecoCell may produce better surface finishes because of the less expansive foaming reaction associated with CO₂ although, as with MuCell, these will not be Class A surfaces.

Which Applications are Most Appropriate for each System?

Because of TecoCell advantages in the foaming of unfilled HDPE Trexel considers TecoCell a more user friendly entry point than the MuCell Process for the blow molding of HDPE on accumulator based systems in the automotive industry.

Many high temperature materials are less appropriate targets for TecoCell based foaming. The most suitable range for TecoCell is between 200 C and 280 C. Packaging applications are well-suited for the TecoCell system, because TecoCell is a more effective foaming process for unfilled Polypropylene and Polyethylene products than MuCell and is also an excellent alternative for lower volume applications in a number of filled materials that do not justify a capital investment in the MuCell Process.

How is this product being marketed?

The product is initially only being offered to the North American market. It is being sold into the injection molding market as well as the automotive blow molding markets. After initial experience in this market, Trexel will look at expanding into other regions.

We will accept a small number of requests from customers outside the North American market for initial development activities in key applications areas.

Customers may order samples from Trexel and may also engage Trexel to consult with them on part and mold design as these contribute to optimal foaming outcomes either with TecoCell or MuCell.

Where is the product manufactured?

The product is being produced in New Jersey.

Where do I obtain Technical Support and Additional product information?

Sales and technical support will be managed through Trexel's Headquarters just north of Boston. The contact point for all inquiries is TecoCell@trexel.com. Interested customers may arrange a web conference with Trexel to better explore whether TecoCell represents an effective solution

for their applications and to compare the TecoCell with the MuCell solution. Trexel will also provide consulting support for the optimization of 1) equipment configurations, 2) part designs, 3) and/or process design for successful foaming.

About Trexel, Inc.

Trexel, Inc., headquartered in Wilmington, MA, has led the development of the MuCell[®] microcellular foaming injection molding technology and has pioneered many plastic processing solutions. The MuCell[®] technology provides unique design flexibility and cost savings opportunities by allowing plastic part design with material wall thickness optimized for functionality and not for the injection molding process. The combination of density reduction and design for functionality often results in material and weight savings of more than 20%. The numerous cost and processing advantages have led to rapid global deployment of the MuCell[®] process in automotive, consumer electronics, medical, packaging and consumer goods applications. Process deployment as well as equipment is supported by teams of highly qualified engineers through Trexel subsidiaries in North America, Europe, and Asia.

Trexel recently extended its product offering with the TecoCell[®] system. TecoCell is a unique chemical foaming technology that provides uniform microcellular structure to injection-molded parts.

For more information, please visit www.trexel.com.