Blow Molding Applications – When to use MuCell® vs TecoCell®

The Trexel Product Policy

The following information will help to determine the appropriate Trexel technology* to use for any blow molding application.

Blow molded products may be produced using either TecoCell® an advanced microcellular chemical foaming agent offered by Trexel, or physical foaming via Trexel's MuCell® Process.

The following is a description of Trexel policy and recommendations for the development of microcellular blow molded products within the automotive industry. It is assumed that most, if not all, automotive applications make use of accumulator style blow molding machinery.

*Trexel is in control of several patents that are necessary for the production of microcellular blow molded articles within the automobile industry. (US 6,376,059, US 6,706,223, EP 1 040 158B2, ZL99813127.7 (China)

TecoCell®

Trexel believes that the most straightforward path to a microcellular blow molded automotive part is with the use of the TecoCell foaming agent, which is a uniquely designed additive complete with a self-nucleating capability. Blow molded parts using TecoCell exhibit excellent property retention including impact strength.

With the use of TecoCell, a manufacturer's primary focus will be on the characterization of the resulting part and whatever modifications may be needed in the parison formation process to account for changes in melt flow or melt strength occasioned by the addition of TecoCell. It is expected that limiting pressure drops in the accumulator head design will improve the performance of the TecoCell product line.

TecoCell users in North America have already successfully commercialized HVAC ducts at weight reduction of 35-40%. These ducts are currently installed on three different OEM platforms.

With the purchase of TecoCell foaming agent, the manufacturer also acquires the right to make, use, and sell blow molded automotive products (only) under the Trexel controlled patents listed above.

Trexel will supply basic processing information and general guidelines concerning key contributing factors to successful foaming such as die head design, processing temperatures, additive levels, back pressure levels, etc. However, given the wide

variation in equipment, material and process, customers who decide to use TecoCell should understand that they are undertaking an internal development process, albeit somewhat less extensive than one that involves physical foaming and the MuCell Process (see below.)

With the use of TecoCell, the manufacturer may expect foaming results which achieve approximately 30-35% weight reduction and should expect to add between 2 and 3% of TecoCell to achieve these results.

The MuCell® Process

The MuCell Process offers a second option to a manufacturer to develop and produce microcellular blow molded automotive parts. The MuCell Process uses Nitrogen gas directly (i.e. physical foaming) to drive cell formation and expansion as opposed to TecoCell which, as an endothermic blowing agent, generates Carbon Dioxide through a chemical reaction. Carbon Dioxide is well known to have a lower driving force than Nitrogen.

While the MuCell Process may afford the opportunity for high weight reductions >35%, it also requires significant levels of development on the part of the blow molder. This additional investment in development and capital may be justified for large blow molded automotive parts running at high output rates.

This development is comprised of the following components:

1. The modification of the existing screw, barrel and accumulator position control (similar to a blocker valve on an injection molding machine) to create and maintain a single phase solution of SCF and polymer which is required to achieve microcellular molding.
2. The purchase of a Trexel SCF system to measure and precisely control the amount of nitrogen gas that is delivered to the melt.
3. The modification of the die and accumulator head in order to control pressure drops in a manner required for microcellular parison formation.
4. The likely requirement to make some modifications to the current material specification in order to achieve high rates of cell nucleation while maintaining required melt strength.

While all of these steps are achievable and have already been achieved by several companies in Japan, Korea, and North America using the MuCell Process, Trexel does not undertake development projects in this field and supplies only limited know-how and guidance to customers wishing to develop such products.

Trexel will supply the following to a customer interested in using the MuCell Process for extrusion blow molding of automotive parts.

1. The Trexel SCF System designed for use with accumulator based blow molding machines.
2. Patent rights as described above.
3. A MuCell optimized screw and screw position control system.
4. A confidential set of general guidelines and recommendations with respect to machine modifications, die head modifications, process conditions and material selection.

None of these guidelines will represent any warranty on the part of Trexel that the part will be successfully produced.

While the challenge of adapting to the MuCell Process is greater than that of using TecoCell, the benefits are also potentially greater. These include:

1. Greater expected weight reduction.
2. More precise control of final weight through precise control of gas.
3. Much lower running cost per part using Nitrogen blowing agent vs. TecoCell chemical foaming agent (<$.01 vs. $.06-.09/ pound blow molded.)

As in the case of TecoCell, Trexel will provide the rights to practice under the Trexel controlled patents to those customers who acquire a Trexel SCF System at no additional charge.

Please note Trexel does not currently offer blow molding solutions in Japan, and, outside of Japan, limits its blow molding technology to applications within the automotive industry.