# Rising Resin Prices and "Green" Initiatives Boost Interest in Microcellular Foam

**By Patrick A. Toensmeier**

Suppliers of plastics packaging are facing the "double whammy" of rising material costs and efforts by customers to promote environmentally friendly goods. As a result, many companies are redesigning consumer packaging with an eye toward reduced material use to lower resin costs and meet source-reduction mandates from product manufacturers and retailers.

Among the techniques attracting attention is foam molding, which is being used to make lightweight packages with little, if any, loss of structural integrity. While there is nothing new about the use of foam in molding—and extrusion—to reduce weight and improve some product properties, designers are testing the process on thin-wall (3 mm or less) containers, which, because of their size, haven't been fertile ground for foam molding or extrusion.

One company reporting a surge of interest in this area is Trexel Inc., Woburn, Massachusetts, USA, which licenses MuCell microcellular foam technology for thin-wall parts. The process is used extensively in such markets as automotive and electronics, where it improves dimensional properties like flatness, reduces warpage, and eliminates sink marks. Trexel's recent attractiveness to package designers, however, highlights the cost concerns and business pressures packaging companies are dealing with.

"We have seen a sea change in behavior in the last six months," says David P. Bernstein, president and CEO of Trexel. "There's been a huge boost in feasibility work. All types of companies are coming to us and looking for ways to reduce material costs and make greener packages."

The MuCell process uses atmospheric gases—nitrogen or carbon dioxide—to create foam structures with micron-sized voids in walls as thin as 0.25 mm. Bernstein says injection-molded packaging can employ the process to reduce material use by 6% to 14%, depending on design. Foaming a container with the same amount of material as in a solid-wall process yields savings on the lower end of the scale. Developing a thinner-wall design and foaming it will achieve greater weight savings, albeit with some tradeoff in topload strength.

Extruded sheet produces bigger weight savings. The process reduces the weight of 1- to 2-mm-thick polypropylene sheet by as much as 35%, and produces a net material savings of 15% to 20% after thermoforming, owing to compression of the cell structure.

Bernstein says that while environmental benefits have always been claimed for the MuCell process, packaging companies were never interested. "The material costs were so low for so long that investing in the process didn't make sense." Now, however, Bernstein maintains, the one-time license fee of $100,000 to $150,000 for injection molding can be quickly recovered: "Anyone who buys this process will see a fast payback."

## Thin and Thinner

Not only will molders be able to lightweight packaging and save on material costs, but in most cases, thinner-wall containers can be produced on existing equipment, eliminating the need for the expensive higher-tonnage machines normally required for thin-wall molding, and the attendant costs of higher energy use, reduced floor space, and maintenance.

Bernstein claims that a 150-ton injection-molding machine can produce thin-wall containers with the MuCell process that would normally require a 350- or 500-ton machine if molded in the same thickness with solid walls.

Autobar Packaging Group in Lyon, France, for example, was able to transfer production of a margarine tub from a 550-ton press to 350-ton injection machines it already had by using the MuCell process. The company was molding 150 million tubs and lids per year in a 4 x 4 stack mold. It wanted to increase output to 200 million units without buying new machines. MuCell foam reportedly reduced clamp force by 14% to 23,940 psi and lowered injection pressure 15%, which permitted the tubs to be molded on the smaller presses. The foam also reduced the weight of each tub by 6.5% to 14.2 grams.

Use of the process requires redesign of a package, which, Bernstein says, carries a "development premium." Nevertheless, total savings outweigh the investment and design costs.

The Trexel chief isn't sure if the increased interest in MuCell will result in greater licensing of the process. But he notes that apart from resin prices, the environmental benefits of package redesign will play a growing role in the design to lightweight containers.

## Long Green

Most major retailers are promoting "green" packaging. The world's largest retailer, Wal-Mart, is particularly aggressive in this area, and many experts say other merchants will follow its lead.

Last February 1, as part of a company-wide initiative to promote ecologically benign operations, Wal-Mart introduced an "environmental scorecard." Vendors use this checklist to evaluate their success at reducing the solid waste, carbon footprint, and environmental impact of their products. The scorecard rates such areas as greenhouse gas emissions necessary for manufacture, the value of materials used in products and packaging, the product-to-packaging ratio, use of recyclate, and design innovation.

Among Wal-Mart's corporate goals is a 5% reduction in product packaging by 2013, and a 25% reduction in solid waste generated in stores by 2008. Such savings will result in sizable bottom-line gains. The retailer, which has one of the largest truck fleets in the U.S., estimates that it could save $52 million a year by increasing fleet mileage by only 1 mile per gallon.

Against this backdrop it's easy to see why Wal-Mart—and other large retailers—are promoting green packaging and other eco-friendly initiatives: It's good for business as well as the environment.

"Small changes to packaging can have significant impacts on the use of materials, manufacturing, shipping containers, trucks, storage, refrigeration, waste, and the energy used for production, transportation, and waste," says Kevin Thornton, a Wal-Mart spokesperson. In an email response to questions about the retailer's packaging-reduction program, Thornton noted that Wal-Mart is already seeing environmental and economic benefits in stores from the effort. "We hope that the changes that occur in our supply chain will extend throughout the global retail industry."

The retailer doesn't plan to dictate what types of materials or designs suppliers should use to meet its packaging-reduction goals. But the objective is clear: "We are committed to finding ways to reduce packaging across our global supply chain to reduce trash and emissions, safeguard raw materials, and save money for our suppliers and our customers."

Trexel has had discussions with Wal-Mart to understand its goals in the packaging-reduction program. "They are curious about MuCell and have people who are willing to learn about it," Trexel's Bernstein says. "I don't think they'll get into recommending any materials or processes, but I do think they're going to create an environment for us without promoting our product."

## The Time Is Now

Bernstein suggests that if any time is propitious for establishing the technology in a new market, this is it. "The key to moving MuCell into packaging is to get more commercial-scale activity," he says.

One benefit of the process is that it can be used with any packaging material. Bernstein reports that one company, Plastic Technologies Inc., Holland, Ohio, USA, uses it to foam PET bottles for noncarbonated beverages.

MuCell can also be used with the biodegradable resins polylactic acid (PLA) and polyhydroxyalkanoate (PHA). "I'm aware of a small number of trials being conducted with these materials," Bernstein says, without identifying the participants.

Bernstein claims that the foaming process can improve the processing properties of PLA and PHA. Both materials have different viscosities and crystallization rates, can be harder to inject than conventional packaging resins, and don't freeze up as quickly. The foaming process tends to minimize these problems, he says.

MuCell's biggest competitors, Bernstein says, are the macrocellular-foam technologies. "But these have limits because they can't get as much foaming in a structure as MuCell."

Trexel will be exhibiting at K 2007 in Germany this October. Among the products Bernstein expects to have on display are examples of biodegradable resins molded or extruded with MuCell microcellular foam.

The ability to use MuCell with PLA, PHA, or other bioresins could be the deciding factor that moves it into the mainstream of packaging applications. If retailers maintain their green initiatives and resin prices continue to rise, or even stabilize at current levels, there could be a lot more demand for a process that meets both economic and environmental needs.