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Why microcellular technology could have a big packaging future

ALL ROADS LEAD TO FOAM

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No place like foam

Biopolymers, recycled content and barriers are no obstacle to foaming technology. **Steven Pacitti** talks to one supplier that expects strong long-term growth in the packaging sector

An ecoPET tray produced with Promix technology is lighter and uses less plastics

There is a lot of talk about recycled content, but converters and brands are faced with a myriad of other challenges in 2022, a significant one being soaring production and raw material costs. The attractiveness of reducing raw material consumption cannot be overstated and so, it would seem, there is a promising opportunity for foaming technology.

Indeed, the continued pressure on companies to reduce their ecological footprint is set to boost the technology further, claims Rolf Heusser, chief executive of Swiss firm Promix Solutions, which specialises in the areas of mixing, foaming and cooling for plastics processing and polymer production.

Microcellular technology is the fastest growing main business of Promix and although only 30 per cent of the company's systems currently go into the packaging area, it sees a big potential for it in the longer term.

"We started with trays already eight years ago," says Heusser. "However, in the last two years, we see significantly increasing demand in the area of trays and cups using PP, PET or biopolymers, and a number of key processors are in the process of evaluation and market introduction. In addition, we started with bottles two years ago. There are many projects that are still in the development stage but look very promising."

Promix has approximately 30 systems in the field of packaging, with the more recent installations providing density reductions of around 20 per cent.

In real terms, most microcellular solutions show a 15-30 per cent density reduction over traditional plastics alternatives, but 50 per cent is achievable, claims Heusser, and even more when in combination with specific raw materials, such as those used for hot meals.

"About 90 per cent of the raw material savings are net cost savings, with a small amount used for the gases and nucleation additives," explains Heusser. "Promix microcellular technology can be installed as retrofit in existing lines as well as for new ones. After installation, the line can still be used for the production of solid products without any limitations and without removal of any equipment."

But how does foaming technology work? For Promix, the concept involves the dispensing of environmentally neutral gases, such as nitrogen and atmospheric carbon dioxide, with a gas dosing system into or after the extruder, using an injector and mixing technology. A special mixer as well as cooling equipment installed downstream of the extruder is said to guarantee the 100 per cent solving of the blowing fluids in the melt, as well as helping to lower and stabilise the melt temperature. The creation of the microcellular structure takes place after the melt passes the die outlet. In addition, very small amounts of nucleation additives are added.

"Nitrogen can be collected directly from the atmosphere with a nitrogen generator," explains Heusser. "Carbon dioxide is collected from the atmosphere with industrial equipment. No additional carbon dioxide is required. In contrast, other light foams used in packaging, for example, meat and hamburger trays, are [typically] foamed with isobutane, a blowing fluid that has a big impact on global warming."

What makes Promix's material unique, according to Heusser, is the smallest microcellular structure on the market. This is the basis for high mechanical strength due to a turnkey solution including precise gas dosing, advanced cooling mixer technology – in order to increase melt strength and achieve small cells – maintenance-free injector technology, and specially developed nucleation additives under the Promix Procell trade name.

"Our team supports the whole value chain from feasibility study to start-up and product development," says Heusser. "Unlike with other suppliers, there are no Promix licence fees, just easy-to-use technology, even running in countries with very limited infrastructure.

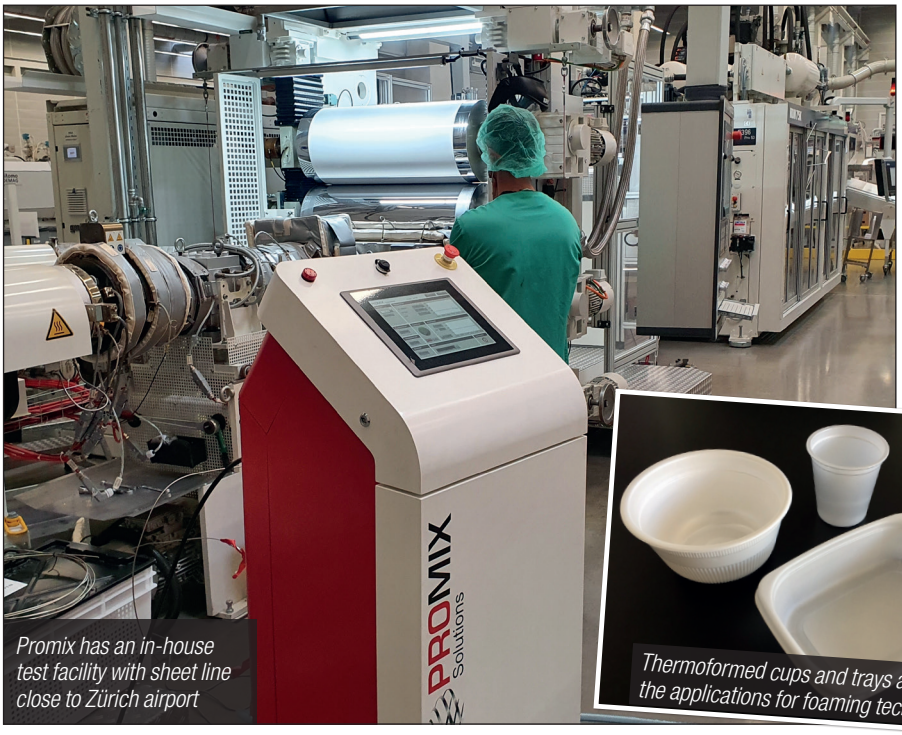
"We sell to converters as well as directly to original equipment manufacturers."

Chief executive Rolf Heusser says that Promix is seeing increasing demand in the area of trays and cups using PP, PET or biopolymers

Below: Promix has achieved density reductions of around 15 per cent with PE shampoo bottles

Examples of customer projects for Promix include PET and PP trays and cups for food packaging sheet lines with throughput of between 500 and 1,500kg/hr, with an A-B-A structure and density reductions of between 20 and 30 per cent. Other examples include PS/PET yoghurt cups (form-fill-seal process), PP bowls for hot meals (A-B-A structure and density reduction of up to 70 per cent), and PE shampoo bottles with density reductions of around 15 per cent.

"For one customer we have a yoghurt cup made of PS running at a throughput of 800kg/hr," explains Heusser. "It is an A-B-A structure with the B layer foamed by 35 per cent. PS cost is $0.75 per pound, so with the line running 24 hours a day for 250 days a year, net savings of $1.4 million are possible per year. Total weight reduction using Promix microcellular technology is 20 per cent.



Promix has an in-house test facility with sheet line close to Zürich airport

Thermoformed cups and trays are among the applications for foaming technology

"Another customer is making PET trays at 1,000kg/hr with the line used for both solid trays and microcellular technology trays. Weight reduction is 18 per cent. PET cost is $0.60/lb, so running 100 days a year with microcellular technology is giving the customer net savings of $467,000 a year."

Eco-credentials

While the use of recycled content is likely to be an increasingly moot one for light foamed materials, the Promix microcell material, however, is recyclable in the same way as solid raw materials.

The Promix technology works just as well for recycled raw materials, explains Heusser, but the quality of the material is key. "It works just as well for 100 per cent bottle flake PET with good cell structure and product quality. In the area of PP/PE/PS, the cell structure is affected by the quality of the recycled material. Poor quality will lead to bigger cells. However, good quality recycled raw material grades can be processed nicely in concentrations of up to 100 per cent."

The scrap, for example from thermoforming, can be fully recycled and, unlike with chemical foaming processes, there is no foaming powder residue, claims Heusser.

"With the typical density reduction of 15-30 per cent, separation by flotation is still working well," says Heusser. "The density of ecoPET [Promix's foamed PET process] is typically 20 per cent lower than solid PET, which means still above 1.0 and will therefore sink in the flotation process. Adding fillers such as talcum or calcium carbonate does not conflict with microcellular technology, and our solution works well in combination with fillers up to 50 per cent. In this way, density can be maintained at the same level as solid raw materials if required."

The technology is also said to work nicely with biopolymers such as polylatic acid (PLA) and other starch-based raw materials, with a number of new developments ongoing to introduce it with bio-based raw materials.

"It helps to make the high-priced biopolymers more competitive, and comparison testing has proven that the significantly increased surface from microcellular technology helps to accelerate the degradation/composting process," he adds.

As for barriers, Heusser cites no negatives in combination with PET, PP, PS or PLA. If the raw material barrier is not good enough, additional thin barrier layers can be added (they will be solid layers), for example in milk bottles.

"Microcellular technology is the fastest growing main business of Promix and is by definition within the focus of further developments," admits Heusser. "Our main focus is developing technology and equipment to further reduce cell size."

Promix has an in-house test facility with sheet line just 20 minutes from Zürich airport, while a number of machine builders have Promix microcellular test equipment on their test lines.

"Our latest development is Procell nucleation additives that give outstanding small cell microcellular foams, as well as a new patent-pending gas dosing technology in order to dispense in an accurate and easy-to-operate way nitrogen or carbon dioxide in a range of 10g/hr up to 10,000g/hr with the same system, without any changes."

Foaming technology is not limited to a small section of the market. Far from it. Applications include thermoformed cups and trays, as well as extrusion blow moulded articles such as shampoo bottles and milk containers. With benefits including raw material reduction, improved thermal insulation, and reduced environmental footprint and costs, microcellular solutions have huge potential for growth. Being resin agnostic does not do it any harm, either.

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