Foamed beads for added value, Sulzer's new coextruded bead foam technology

Everybody is familiar with the foamed protective packaging for electronics or household goods. Upon closer inspection, it will be noticed that this package is composed of many small beads which are fused together. The process of shape molding foamed beads or particle foam is particularly attractive because it allows to make complex parts of almost any shape and size. Most protective packaging is made from expandable particles based on expandable polystyrene (EPS). This material is widely used because is quite inexpensive, easily available, and easily moldable. One of the big advantages is that it can be transported in an unexpanded state and then be expanded at the molding site. However, even though EPS is extremely useful for many applications, it lacks the mechanical strength and impact resistance required for certain applications. For instance, transportation boxes for hot food delivery, or car bumpers where impact properties are key. For such applications, expanded beads based on polypropylene, ePP are used. While solutions based on EPS and ePP are well established, there is still a demand for even better mechanical properties with increased recycled material content able to reach higher temperature stabilities or even electrical conductivity, which then requires a new technical approach.

With new and improved materials, new types of beads can be foamed, such as from high-temperature resistant polyamide, a development that is supported by new and improved molding and forming technologies. Traditionally EPS and ePP have been molded using steam chest molding. This process involves heating of the beads by steam which can become expensive when high temperatures are needed to mold a material or when materials are sensitive to water. Therefore, the industry is developing non-steam processes like Atecarma®, which implies a glue layer, or the Wave Foamer which heats up the foam via exciting the dipols inside the material.

For many years, Sulzer have designed and sold foam extrusion lines for expandable and expanded particle foams, including EPS, ePP and bio foams like expanded polylactic acid ePLA. The company has built up considerable know-how in the process design of polymer equipment and processes including extruders, melt coolers, static mixers, underwater granulation, and die plates design. Recently, in collaboration with leading Swiss institutes, Sulzer has developed a method to produce particle foam, where each particle or bead is covered by a external layer made of a similar or different polymer material.

About us

Sulzer has been providing key components, like devolatilization systems, loop-and plug flow reactors and entire skid-mounted systems to produce various kinds of polymers for over two decades. To increase your competitive edge, we are continuously challenging the boundaries of established solutions to develop processes and applications that yield higher-value products, have a smaller footprint, are safer to operate, more environmentally friendly, more energy efficient and more economical.

**How can we help you?
Contact us today to find your best solution.**

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The new development is a coextrusion method. Coextrusion is well known for films, where many layers are extruded on top of each other. It is also known for foamed sheets where a top layer is extruded at the same time with a foamed layer, as for example in temperature resistant food trays made of a layer of foamed polyethylene terephthalate (PET) with a top layer of non-foamed PET. With our new method we propose to apply the coextrusion concept to an underwater pelletizer to form beads or particles with a foamed core covered with a non-foamed external layer.

One of our first developments involved foaming a core of a material which has good mechanical properties, but a relatively high melting point, which makes steam chest molding challenging or not economically attractive. By coextruding a external layer of a material with a lower melting point, the produced beads could be molded at pressures which would be expected from the external layer material. Figure 1 shows plates and Figure 2 a toy truck, which are formed in this manner. In figure one, the external layer material was colored blue and the thickness varied, decreasing from top to bottom, and the uniformity of the external layer layer can be seen in this illustration.

Figure 1

Figure 2

Endless possibilities?

While many polymer combinations can be imagined, each material must be carefully selected considering an assessment of the foaming and process conditions. With our state-of-the-art pilot plant for producing beads, specific applications can be developed and trialed for validation for those interested in the technology.

Potential applications include:

- External layer layer additives, such as shear sensitive flame retardants eliminating the extensive mixing and preparation required for the foamable melt.
- Dipole addition allowing RF technology heating and better conductivity.
- Antistatic or conductive additives adding these properties to the final form.
- External layer layer made of water-soluble materials such as PVOH to enable better recyclability.
- Nano particles or fiber reinforcement increasing mechanical properties without increasing the density.
- Majority recycled polymer core with virgin polymer external layer, solving the potential challenge of lower quality foam with recycled materials.
- Allowing the production of difficult to mold materials by covering them with an easy to mold external layer, such as PLA which could be then covered in an non PLA external layer.

The options are endless. If you have a challenge to be solved we might have the right technology.