Expancel Microspheres in extrusion

Expancel

Nouryon

In this leaflet we have put together our recommendations for best practise when using Expancel Microspheres in extrusion. You will find information such as what Expancel products to use, what to think about and what to avoid.

Addition

The addition should be about 0.5 to 3 percent Expancel MB (masterbatch with 65 percent microspheres in a carrier of EVA) or 0.5 to 2 percent Expancel DU (pure microspheres).

When using DU, the thermoplastic granules should first be wetted with 0.5 to 1 percent mineral oil, or plasticizier, in order to achieve a tacky surface to which the spheres can attach themselves.

Temperature vs Expancel products

First choice Expancel products at different processing temperatures:

140–200°C	920 DU 120/093 DU 120
170–200°C	930 DU 120
190–210°C	951 DU 120/950 DU 80
200–230°C	980 DU 120

All these products, except for Expancel 093 DU 120, are also available as masterbatch.

As the microspheres start collapsing after achieving their maximum expansion, the result will also depend on residence time in the machine.

We recommend to always evaluate at least two different products in order to find the best choice for the process in question.

Extruder

L/D ratio preferably ≤ 32.

Both single and twin screw machines work when expanding with Expancel, but single screw machines are usually the best choice. It is not necessary to make any adjustments to dies or screws when processing with microspheres.

Vacuum or venting zone (mostly found on twin screw machines) must be plugged. With an open vent, the spheres will start to expand due

to the pressure drop and the expansion of the final product will be very poor.

Screws with mixing heads or designs that expose the material to very high shear forces might destroy the spheres.

The expansion takes place when the material leaves the die. The pressure within the machine is high enough to prevent the spheres from expanding.

Melt pumps can destroy the microspheres due to the high pressure and shear generated and shall be avoided.

Residence time

Long residence times affect the polymeric shell's barrier properties, and the propellant gas will therefore leak out easier from the spheres. The shell will also be discolored - yellow/brown - due to degradation of the polymer.

The residence time is easiest altered by varying the screw speed. Graph 2 (opposite side) shows that the shorter time in heat, higher speed, has a positive effect on the expansion.

Temperature settings

The temperature should be lowest near the hopper, and thereafter gradually increase to the highest temperature at the die.

The temperature of the die has a greater influence on the expansion than the barrel temperature. That is why adjustments to optimise expansion has the best effect if the temperature on the last zones is changed. In graph 1 (opposite side) you can see an example of the resulting density at different temperatures.

Output

The haul off speed has to be adjusted - increased - when the material starts to expand in order to keep the dimension of the profile constant. You also acheive the same effect by lowering the output from the extruder - lower speed of the screw.

Melt strength

The melt strength will be affected when micro-spheres are introduced into the polymer melt. This can cause problems if the speed of the haul off needs to be increased drastically to keep the correct dimension of the extruded profile.

The effect on melt strength is also of importance in production of blown film and the addition level of Expancel should therefore be kept low.

Calibration/cooling

A rapid cooling can inhibit some of the expansion giving a smoother surface of the profile.

Co-extrusion

Since the spheres are present, and normally expands, all the way to the surface, it might be necessary to co-extrude the profile with an unfoamed outer layer if a glossy surface is requested.

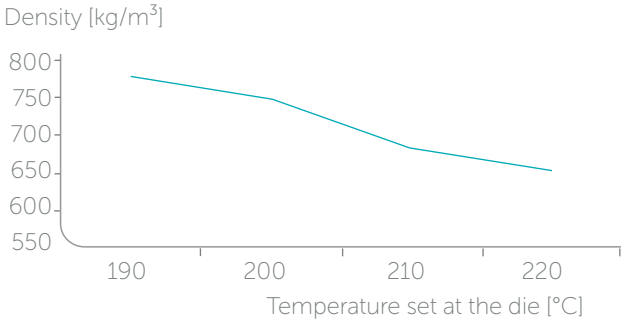
Matrix

Most thermoplastics with processing temperatures up to 230°C are possible as matrix. Easy flowing materials are usually easier to expand, so a high MFI value is beneficial.

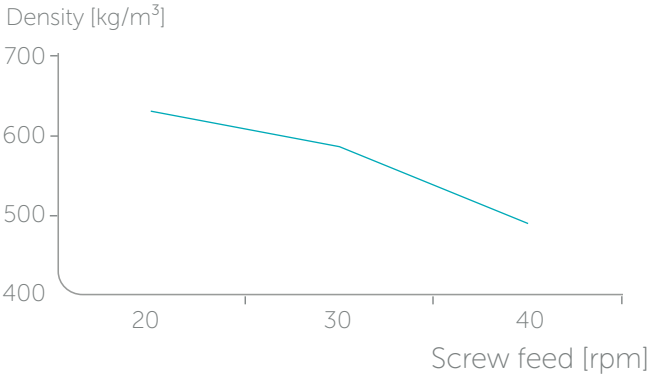
Examples

SEBS, SBS, TPU, ABS, PS, PE (LD, HD and MD), PP, TPO, PVC-P.

Results from extrusion



Graph 1
Extrusion of PP with 2 % 980 MB 120 at different temperatures.
Screw speed 20 rpm.



Graph 2
Extrusion of SEBS with 2 % 951 MB 120 at 190°C.

To find out more about our microspheres, visit our website:
nouryon.com/products/expancel-microspheres

or contact us at:
E: info.expancel@nouryon.com

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