Omya Packaging
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Blow Molding

Calcium Carbonate for high Performance Packaging

THINKING OF TOMORROW

About Omya

Omya is a leading global producer of industrial minerals – mainly mineral additives and pigments derived from Calcium Carbonate and dolomite, and a worldwide distributor of specialty chemicals. Omya provides a wealth of product solutions and services that contribute to its customers' competitiveness and productivity in multiple industries such as Construction, Printing & Writing, Technical Polymer Applications, Packaging, Consumer Goods, Agriculture & Forestry, Water & Energy. Founded in 1884 in Switzerland, Omya has a global presence extending to more than 175 locations in over 50 countries with 8,000 employees.

How blow molded packaging items benefit from Calcium Carbonate

Calcium Carbonate helps save energy or increase the production output

Polyolefins filled with Calcium Carbonate transfer heat much faster. As a result, they allow production lines to run faster achieving higher throughput.

Calcium Carbonate allows optimized formulation costs

Given the price volatility of polymers, Calcium Carbonate contributes to lower and more stable raw material costs. It can be added to the production process easily by using highly filled masterbatches.

Calcium Carbonate helps down-gauge packaging

Adding Calcium Carbonate in many cases leads to an improvement of the physical packaging material properties, e.g. the tear resistance of films, the environmental stress crack resistance (ESCR) of blow molded products, etc.

This positive effect often allows down-gaugeing the specific packaging and additional cost savings realized while preserving the same material performance.

enhanced by Omya

Calcium Carbonate and loading levels

For blow molding, Omya recommends the use of Omyafilm®, a finely ground, specially surface-coated, high purity Calcium Carbonate, with controlled particle size distribution, especially tailored for demanding polyolefin applications.

In final HDPE blow-molded articles, typical Calcium Carbonate levels range from 5% to around 30%, sometimes even higher, depending on the product profile that is targeted.

Omyafilm® 707 Masterbatch

Omyafilm® 707

To disperse Omyafilm® powder in single screw extruders such as used in blow molding, Omyafilm® has to be pre-dispersed in a masterbatch with typical filler loadings between 75% and 85%. With Omyafilm® products, excellent masterbatch quality is ensured, as our high-quality grinding- and treatment technologies provide superior dispersion of Omyafilm® within the polymer matrix.

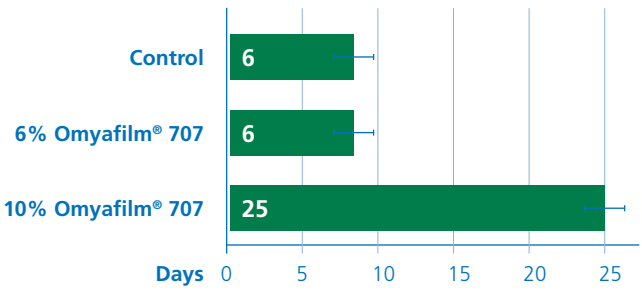
Environmental stress cracking resistance

ESCR - Environmental stress cracking is the number one cause of failure for many containers molded from HDPE polymer even when in contact with mild chemicals. Omya Calcium Carbonate improves ESCR significantly.

Chemical agents can accelerate the extension of cracks through a polymer under stress by diffusion. Because of its effects on morphology, Calcium Carbonate blocks this crack propagation, creates a longer (torturous) path for crack growth, and thus can greatly prolong the time until failure. Tests according ASTM 256-95 (with 10% Igepal as the test agent at 50°C) show an increase in stress cracking resistance with increasing Calcium Carbonate levels.

When using 10% of Omyafilm® 707 the ESCR was at 25 days. This means further delay of ESC failure and extended useful bottle life.

ESCR - F50



Reduced cycle time

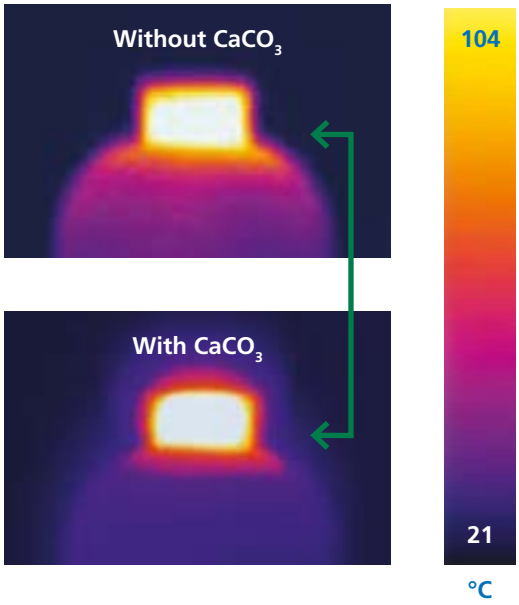
Calcium Carbonate allows a reduction of overall cycle time in the blow molding production process as the cooling time is reduced.

This is because the thermal conductivity of Calcium Carbonate is approximately 6 times higher than HDPE:

Material	Thermal Conductivity [W · m^{-1} · K^{-1}]
HDPE	0.4
PP	0.2
$CaCO_3$	2.7
PP + 20% $CaCO_3$	0.4
PP + 40% $CaCO_3$	0.6

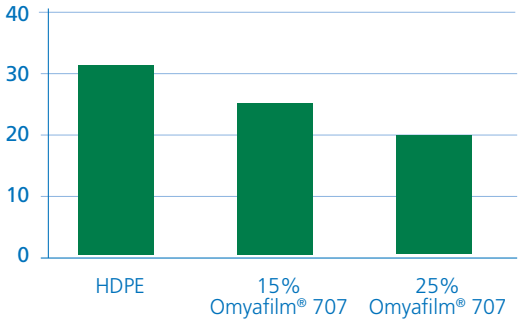
The benefit is illustrated in the thermographic pictures of blow molded bottles that are ejected out of the mold after a given cooling time. The pictures were taken with an IR visualizing camera. The brighter the color, the hotter the object. The brighter colors in the top image - containing no Calcium Carbonate - clearly show higher temperatures when compared to the bottle below containing 6% Calcium Carbonate.

In this case, incorporation of 6 % Omyafilm® 707 results in a reduction of the blow time, and an overall cycle time reduction of approximately 10%. The same effect can be seen in multilayer articles where only the core layer is modified with Calcium Carbonate.



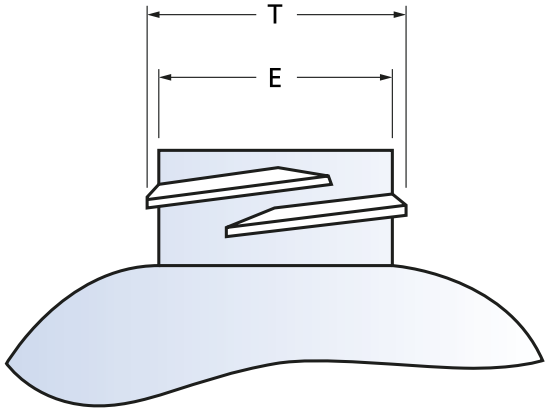
Omyafilm® has almost 7 x higher thermal conductivity than HDPE

Release Temperature [°C]



19 sec cycle time, 0,7 mm wall thickness

Dimensional stability



To keep the weight of a blow molded product constant when adding Calcium Carbonate, the wall thickness can be reduced by down-gauging.

Both with and without Calcium Carbonate, thread dimensions "E" and "T", measured by optical comparison, show stable dimensions, staying within the usual specifications.

In addition, shrinkage is also not affected for bottles that are manufactured with Calcium Carbonate.

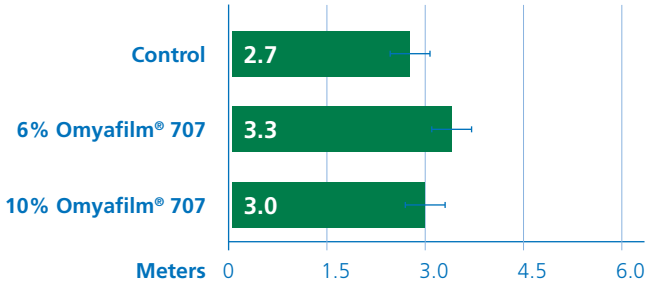
Drop impact resistance

As can be seen in the figure, drop impact performance remains the same within the large experimental error despite the reduced wall thickness of the bottles containing Calcium Carbonate.
All bottles passed the normal (Bruceton stair step) single drop method according ASTM2463, each surviving a single 4.6 meters drop. In order to produce failures for comparison purposes, each bottle was dropped repeatedly at increasing heights until the accumulated multi-drop abuse created a leak failure.

The tested containers resisted about 23 - 32 kg of crushing force. Overall polymer savings are provided due to both reducing wall thickness and the partial replacement of HDPE resin by Calcium Carbonate.

Omya recommends performing tests for containers of customer-specific size, shape and material to determine the actual effects of incorporating Calcium Carbonate on all physical properties of blow molded parts.

Failure hight multi drop



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Omya Packaging

+41 62 789 29 29
packaging@omya.com

Omya International AG
CH-4665 Oftringen
www.omya.com

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