

CRYSTALADD® Nucleating Masterbatch resins are designed to be added to Polyethylene molding and extrusion processes by direct addition to the machine or by pre-blending with the PE resin or other masterbatch additives (i.e. colorants, slip, anti-block etc.) before processing. These masterbatch resins process at temperatures similar to other PE resins and do not require modifications to the melt or mold temperatures, pressures or other processing parameters.

RESIN SELECTION

CRYSTALADD use a high performance nucleation additive that shows high responsiveness to the following types of PE resins:

Melt Index Greater Than 1.0 g/10 Minutes	All PE resins with a melt index over 1.0 show some responsiveness to the nucleator. With higher melt index resins, the crystallization effect is more pronounced.
Melt Index Less Than 1.0 g/10 Minutes	For PE resins with a melt index lower than 1.0, bi-modal and solution PE grades show the best response. Most LLDPE grades with a melt index lower than 1.0 will not react to the nucleator.

INJECTION MOLDING

For single or multi-cavity mold operations, CRYSTALADD HM-237, HM237B, HM-237E or HM-664* can be added directly to the molding machine or by blending with the PE resin. Loading levels (let-down ratios) are typically in the 1% to 2.5% range, although loading levels may work in some applications.

2.5%	Initial loading level for most injection molding applications.
1.0 – 2.0%	Loading levels for non-barrier applications or for large, thin or ribbed parts that require longer cooling times.
0.25 – 1.0%	Lowest level than can affect crystallization rates; may be possible in higher melt index grades of PE.

Once the CRYSTALADD masterbatch is added in, the molded parts will typically become larger in dimensions at the same cycle time. This is due to the change in shrinkage which is caused by how CRYSTALADD modifies the crystallization of the PE. To bring the parts back into dimension, the cycle (cooling) time should be adjusted down in 5% increments. Typical cycle time reductions are between 15% and 25%. No other processing adjustments should be necessary.

***NOTE: HM-664 is designed for large, heavy-gauge industrial parts.**

BLOW MOLDING

CRYSTALADD HM-237, HM-237B and HM-237E can be used for extrusion blow molding and can be added directly to the blow molding machine or by blending with PE resin. Loading levels (let-down ratios) are typically in the 1% to 2.5% range, although loading levels may work in some applications.

2.5%	Initial loading level for most blow molding applications; best for high barrier, chemical resistance and ESCR performance.
1.0 – 2.0%	Loading levels for non-barrier application.
0.25 – 1.0%	Lowest level than can affect crystallization rates.

Once the CRYSTALADD masterbatch is added in, the molded parts will typically become larger in dimensions at the same cycle time. This is due to the change in shrinkage which is caused by how CRYSTALADD modifies the crystallization of the PE. To bring the parts back into dimension, the cycle (cooling) time should be adjusted down in 5% increments. Typical cycle time reductions for blow molded parts are between 10% and 20%. No other processing adjustments should be necessary.

Some die swell may occur once the CRYSTALADD masterbatch has been added. If parts are clear or natural in color, a slight color shift might also occur indicating the presence of the CRYSTALADD nucleator. For blow molding applications it is important to make sure that the process equipment and downstream equipment can handle the faster production speeds when using CRYSTALADD.

When blow molding bottles and containers using PE resins with a melt index below 2.0, it has proven successful to blend in a 2.0 melt index or higher PE resin (at approximately 20% loading) which allows the CRYSTALADD to function more effectively and achieve cycle time reductions and barrier improvements.

BLOWN FILM

CRYSTALADD HM-237B is the main grade for use in blown film applications and it shows the best responsiveness to PE resins that have a 2.0 or greater melt index. However, when blowing film using PE resins with a melt index below 2.0, it has proven successful to blend in a 2.0 melt index or higher PE resin (at approximately 20% loading) which allows excellent barrier and clarity improvements to be achieved. CRYSTALADD can be added to each layer of a multi-layer film at a 2.5% loading level. Examples for PE blends are as follows, assuming that the balance is a 1 melt index or lower PE:

Extrusion Type	Best Results	Minimum Results
Mono-Layer	75% 2 MI or higher PE	At least 25% 2 MI or higher PE
Co-Extrusion A-Layer	100% 2 MI or higher PE	At least 25% 2 MI or higher PE
Co-Extrusion B-Layer	50% 2 MI or higher PE	At least 25% 2 MI or higher PE
Co-Extrusion C-Layer	50% 2 MI or higher PE	No change to current blend

CRYSTALADD can be added to the extruder with no changes to process temperature or pressure. Best results will be achieved when the extrusion rate is lowered and / or the frost line height is raised. By allowing the nucleator to have the longest residence time in the molten polymer, the additive will show the most response in the final film properties.

It should be noted that CRYSTALADD can be added to any type of polyethylene, including HDPE, MDPE, LLDPE and LDPE. The nucleating masterbatch shows the least performance improvement in LDPE-rich films, due to the high amount of long-chain branching.

For the best barrier improvement, blend 2.5% CRYSTALADD HM-237B into each HDPE layer. For the best clarity improvements, blend 2.5% CRYSTALADD HM-237B into all layers of a co-ex structure.

PURGING

It is recommended to clear the molding machine/extruder of any latent nucleator after processing if you do not wish to affect the crystallization rate of other products. Running a purge compound, mineral filled PE or a standard LDPE through the machine for 30 minutes should eliminate and remaining CRYSTALADD.

USE WITH POLYPROPYLENE

CRYSTALADD is primarily designed for use in PE but it can be added to polypropylene resins to achieve cycle time reductions and dimensional stability improvements. Many PP resins will already contain a high performance nucleator pre-formulated, in which case the addition of CRYSTALADD may not yield an advantage. However, if it is added to a PP resin with a generalized nucleating agent, or to recycled PP, then there can be performance improvements noticed, especially in large or high-throughput molding applications. Loading levels for CRYSTALADD in PP would be 1.5% to 2.5%.