



Tech Bulletin
Flexible Films

Blending Tie Concentrates with LLDPE Resins

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Tie Layers are Essential for High-Barrier Packaging

Today's flexible packages for most perishable foods are made with coextruded films containing barrier layers that extend shelf life and maintain product quality. High barrier resins such as ethylene vinyl alcohol (EVOH) and nylon require an intermediate adhesive or tie layer to bond to polyolefin layers and maintain package integrity. Many commercial tie layer resins or tie concentrates are available that bond barrier polymers to polyethylene (PE).

Tie concentrates are designed to be blended at low levels with polyethylene and typically offer cost savings, reduced inventory, and manufacturing versatility. However, tie concentrates are not compatible with all PE blend resins. Certain additives or copolymers in the PE can interact with the functional components of the tie concentrate resulting in low bond strength and possible delamination. In addition, the choice of PE blend resin can affect important film properties such as interfacial clarity and the package's physical properties.

NOVA Chemicals has studied the challenges associated with high barrier coextrusions and evaluated many tie concentrate blend resins. This bulletin presents linear low density polyethylene (LLDPE) grades that are suitable for blending with tie concentrates while maintaining key coextruded properties.

Coextruded Film Properties and Challenges

The most important function of the tie layer is to maintain adhesion between dissimilar layers in a coextruded film throughout package forming, filling, distribution, and consumer use. Poor adhesion will lead to package integrity problems and/or barrier loss as well as poor appearance. Certain additives used in PE blend resins will react with the tie concentrate's functional component rendering it unable to form bonds with the adjacent layer.

Maintaining adhesion between layers in coextruded films that are stressed or elongated after manufacture can be particularly challenging. Processes such as thermoforming, machine direction orientation, or in-package reheating can create differential stresses between layers that often lead to delamination. For these applications, a high performance tie resin that absorbs and dissipates interfacial energy is required to maintain adequate adhesion as the stresses build and subside.

Another challenge is maintaining film clarity and optics without sacrificing adhesion. Tie concentrates used to adhere EVOH or nylon to PE contain grafted maleic anhydride that forms covalent bonds with polar functional groups. The bonds that form as the polymers solidify generate stresses that may distort the interface between the barrier and PE tie layers. A severely distorted interface will give the film a grainy or "ground-glass" appearance. The right PE blend resin in the tie layer can significantly reduce this problem and improve film optics.



Certain blends in the tie layer can improve film optics by reducing interfacial clarity distortions

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SURPASS® FPs016-C Resin for High-Performance, High-Clarity Coextruded Films

NOVA Chemicals' applications development group has studied the challenges associated with tie concentrate blends and identified an advanced LLDPE for use in demanding high-barrier films. SURPASS FPs016-C resin provides outstanding clarity and post-stress adhesion when used as a tie concentrate blend resin in most barrier coextrusions.

SURPASS FPs016-C resin has a unique polymer morphology that gives it outstanding physical properties in the solid state and good processability during extrusion. This morphology enables the resin to absorb energy and dissipate interfacial stresses that create uneven interfaces and result in poor interfacial clarity. Film optics can be further enhanced by using proprietary blends of FPs016-C with certain tie concentrates and other PE resins.

SURPASS FPs016-C resin is octene LLDPE, produced on NOVA Chemicals' Advanced SCLAIRTECH™ manufacturing platform. It contains a process aid that reduces melt fracture when used as an exterior skin or sealant layer.



NOVAPOL® Butene LLDPE Resins for General Purpose Tie-Concentrate Blends

Barrier film applications that are less demanding in terms of optics or post-manufacturing stress still require robust adhesion and consistent performance. NOVA Chemicals offers several butene LLDPEs which are appropriate for use in layers with tie concentrate blends. These grades are not commonly used in demanding applications such as thermoforming films or boil-in bag pouches, but are generally suitable for use in bag-in-box for dry foods or heavy duty sacks.

Publications and References

Ward, D., "A Practical Model for Predicting Interfacial Flow Instabilities in Polyamide-PE Film Coextruded Films Containing Tie Concentrate Blends." TAPPI PLACE 2008 Conference Proceedings

Kamykowski, G. "Effect of Layer Geometry on Tie Layer Adhesion of Coextruded Films" TAPPI PLACE 1996 Conference Proceedings

FPs016-C Product Info Sheet: <http://www.novachem.com/Pages/product-finder-tool.aspx> (enter FPs016-C in "Search Grades")