



Slip and anti-block additives



Optislip™ and Incroslip™
Complementary solutions for
friction control and blocking.

Control friction. Prevent blocking. Optimize production.

When friction gets in the way, performance suffers

Polymer surfaces often exhibit high friction, which can lead to challenges during manufacturing, processing, and end-use. Excessive friction may cause issues such as poor film winding, difficulties in bag production, and inefficiencies in packaging operations.



Polymer type
(nature, polarity, crystallinity)



Process temperature



Process type
(film, blown/cast, co-extrusion, etc.)



Film gauge & structure



Other additives present
(anti-fog, anti-static, pigment etc.)



Friction control starts here

To address these challenges, Cargill offers two complementary ranges of high-performance slip additives: **Optislip™** and **Incroslip™**.

These solutions are engineered to meet the evolving needs of manufacturers across a wide range of polymer applications—helping improve processability, reduce friction, and enhance end-product performance.



When choosing the right slip additive for your application, it is important to consider several key formulation factors, including:

Slip/blocking performance required

As a general guideline, unsaturated primary amides tend to have the best slip performance (CoF <0.2). Secondary amides are excellent for the control of medium slip (CoF 0.3 - 0.5). Saturated amides exhibit poorer slip properties but improved anti-blocking performance (CoF > 0.5).

Rate of slip development

Generally the smaller the amide molecule, the faster it can migrate, especially in semi-crystalline polymers. Thus oleamide will cause a faster drop in CoF than erucamide. However, erucamide usually yields the lowest ultimate CoF.

Volatility

Lower molecular weight additives are more volatile and prone to cause smoking, chill roll plate-out and die fouling. An indication of the relative volatility can be gained by Thermogravimetric Analysis (TGA). Erucamide is less volatile than oleamide and is therefore recommended for polymers requiring higher processing temperatures. Secondary amides are recommended for engineering polymers.

Oxidative stability

Unsaturated amides are more prone to oxidation due to the presence of the double bond. They may also have small amounts of polyunsaturates present which will significantly increase the rate of oxidation. The undesirable effects of oxidation include increased color, odor, and loss of slip properties/increased blocking. Incroslip additives are the best choice when high stability is needed.

Polymer type

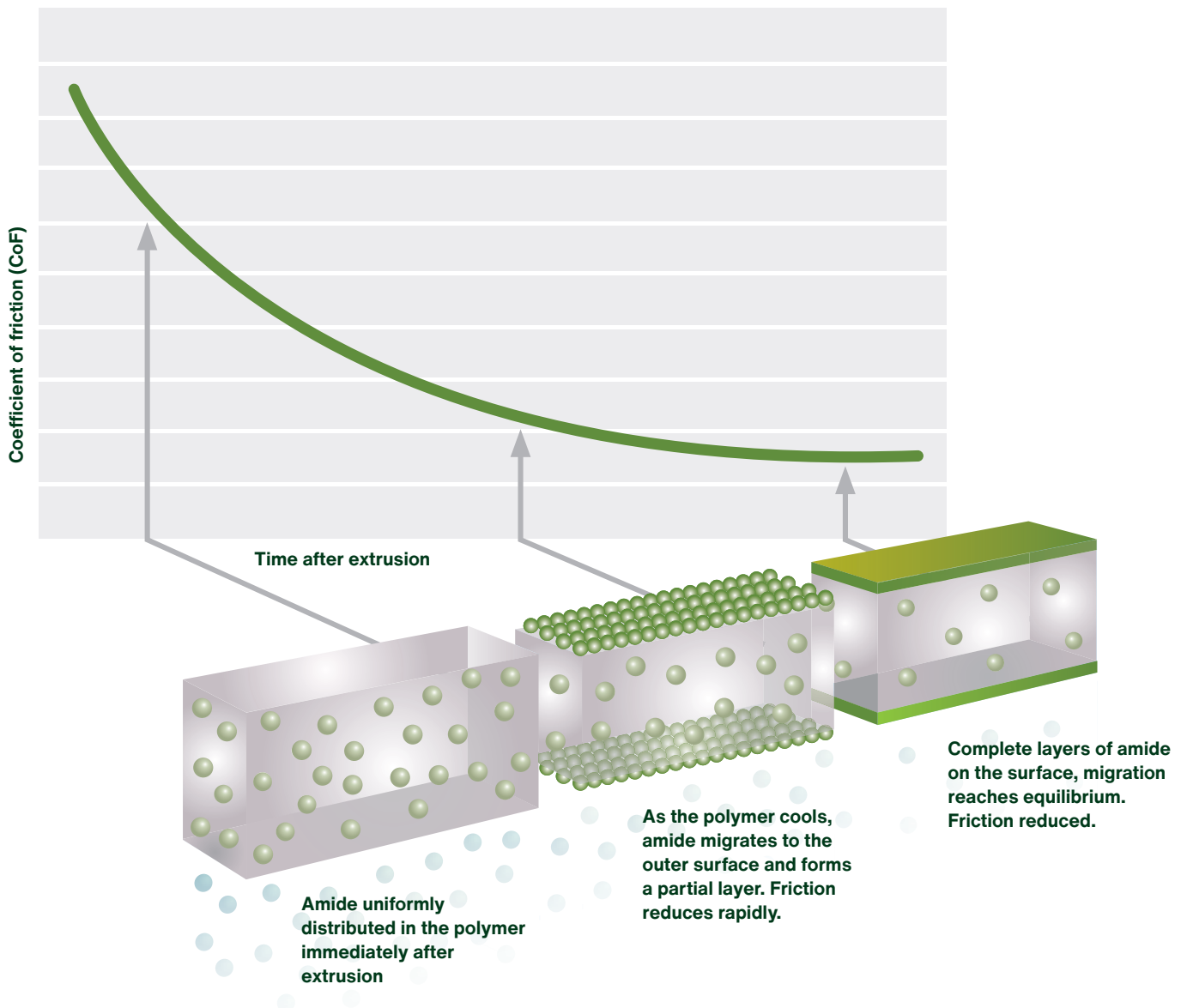
The performance and required inclusion level of the amide will vary depending on the type of polymer. Amide solubility is governed by the relative polarity of the polymer and the additive, and the crystallinity of the polymer. Slip molecules diffuse mainly through amorphous regions of a polyolefin, so with more crystalline polymers, such as PP and HDPE, migration of the amide to the polymer surface will be slower. In more polar polymers, e.g. PVC, amides exhibit greater solubility.

Cargill™ Optislip™ additives

Engineered for clarity, designed for efficiency

The Optislip™ additive product range offers the highest-performing slip and anti-blocking effect. It is suitable for a variety of polymer types and film structures, reducing friction during manufacturing, conversion and end-use.

Slip development in polymers



What makes Optislip™ additives stand out?

Cargill™ Optislip™ specialty additives are incorporated directly into the polymer during the processing stage, pre-compounded or included via masterbatch. They work by migrating to the surface as the polymer cools forming a solid lubricating layer at the surface. This acts to lower the friction or adhesion between contacting polymer surfaces and the polymer and other materials. Experience has shown that Optislip products can be easily incorporated into the polymer. Simple manual mixing prior to processing will normally give an acceptable dispersion, though mechanical means are preferable. The optimum dosage level depends on the polymer type and the degree of lubrication required. We recommend initial levels of around 500 – 2000 ppm in film.



High film clarity



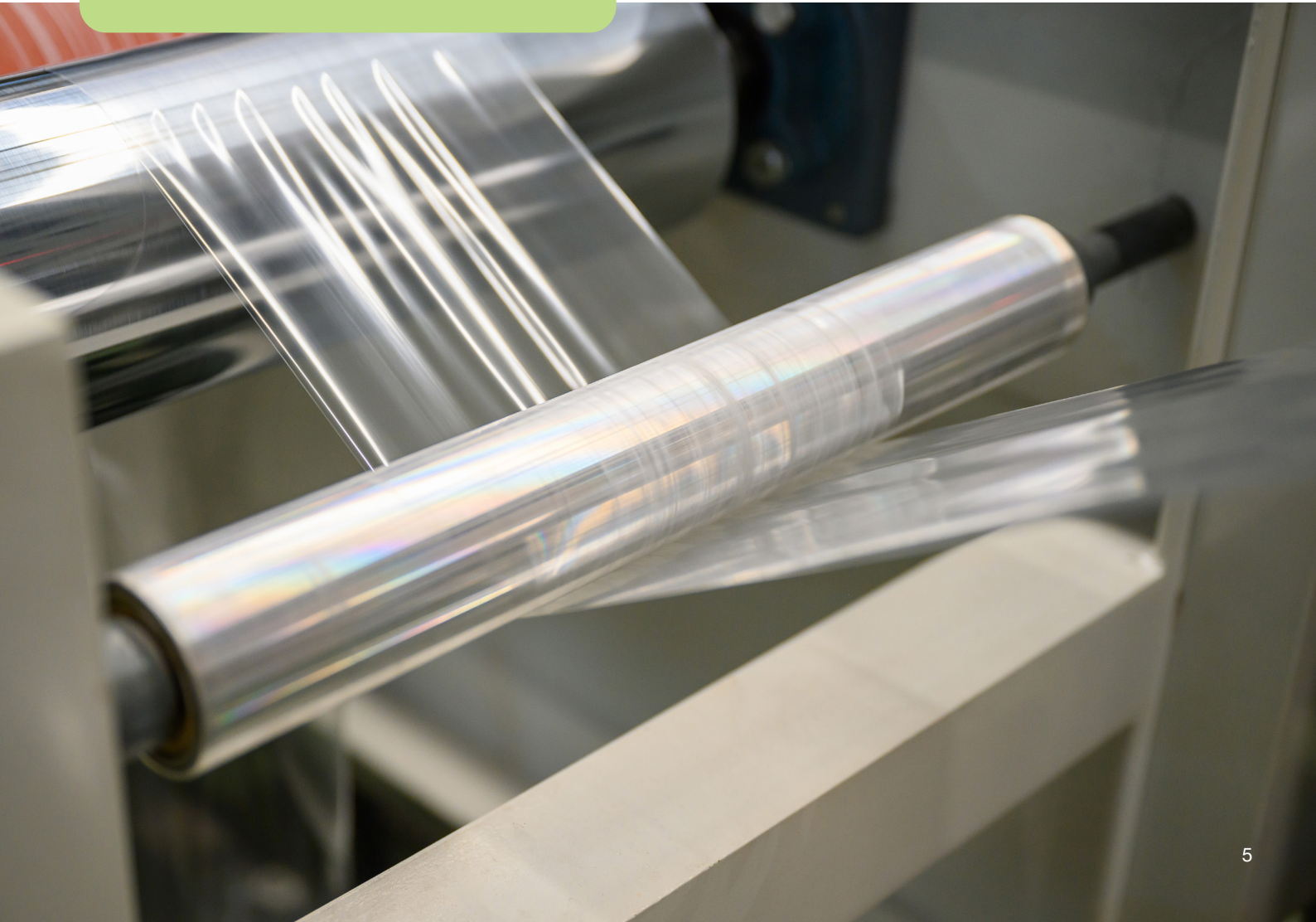
**Low use levels
(500 - 2000 ppm)**



**Slipping or
non-slipping solutions**



**Synergy with inorganic
anti-block additives**



Optislip™ range

Product information



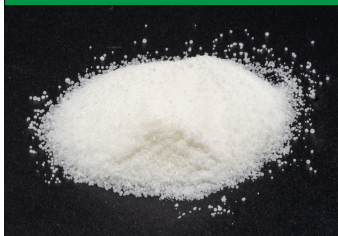
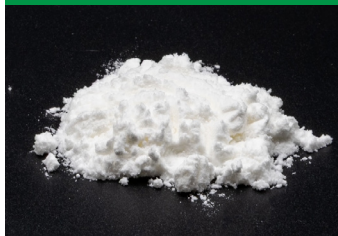
Trade name	Description	Physical form at 25 °C	Raw materials origin	Bio-based* carbon content	Key effects and recommended uses
High slip					
Optislip™ ER	Erucamide	Bead/Powder/ Microbead	Vegetable	100%	Slip/release in polyolefins, PVC and many other polymers. Optislip OR is used as a process aid in WPC.
Optislip™ VRX	Oleamide	Bead/Powder	Vegetable	100%	
Optislip™ OR	Oleamide	Powder/Pastille	Non-vegetable	100%	
Medium slip					
Optislip™ 203	Oleyl Palmitamide	Bead	Vegetable	100%	Medium or controlled slip in polyolefins, especially useful in laminated or co-extruded structures. Also slip in ionomers and other ethylene copolymers.
Optislip™ 212	Stearyl Erucamide	Bead	Vegetable	100%	Medium or controlled slip in polyolefins, especially useful in laminated or co-extruded structures
Low slip and anti-block					
Optislip™ BR	Behenamide	Bead	Vegetable	100%	Mold release and anti-block in polyolefins
Optislip™ SR	Stearamide	Bead/Powder	Non-vegetable	100%	
Optislip™ SRV	Stearamide	Bead	Vegetable	100%	
Optislip™ EBO	Ethylene bis-oleamide	Bead	Vegetable	95%	Anti-block and medium slip/release in polyolefin polar copolymers. Especially useful as a pellet anti-tack in EVA hot melt adhesives. Process aid in WPC.
Optislip™ EBS	Ethylene bis-stearamide	Bead/Powder/ Microbead	Non-vegetable	95%	Anti-block in polyolefins and process aid to improve dispersion of fillers. Also effective as a lubricant for PVC and process aid in WPC.
Optislip™ EBSV	Ethylene bis-stearamide	Powder	Vegetable	95%	

*Calculated or tested according to ASTM D6866 / EN 16640.

Physical forms

Product information

Optislip™ products are available in up to four physical forms. Please check with your local sales contact for availability in your region. Typical particle sizes are given below under product images.

Pastille	Bead	Microbead	Powder
			
Size: 4 mm diameter x 1-2 mm Ensures 100% dosing; reduced potential for agglomeration	Size: 1-2 mm Good general purpose form suitable for the majority of feeders	Size: 0.1-0.5 mm (100-500 µm) Recommended for dry mixing with other granulates	Size: 0.01-0.1mm average (10-100 µm) Recommended for dispersion into liquids or other fine powders



Cargill Incroslip™ additives

Stable, reliable, high-slip performance

The Incroslip™ product range has been optimized to provide different combinations of slip and oxidative stability to suit different polyolefin application requirements. Products in this range can be added via masterbatch, during compounding or extrusion at levels between 0.1 and 1% depending on the application.

Why are high stability additives needed?

Standard slip additives, such as erucamide, oleamide and behenamide are commonly used in many plastics applications, including packaging, automotive and high value plastics. These additives bring many benefits in processing and end-use, including high, fast or controlled slip, and anti-block. However, some of these standard additives contain double bonds which cause the additive to be prone to oxidative breakdown, resulting in poor stability. Poor oxidative stability can lead to issues in the final part over time or when subjected to stressed conditions such as high temperature or prolonged exposure to UV light. Incroslip™ products offer the benefits of slip additives without these drawbacks.

Key performance benefits:



High and long-lasting slip



Low application and release force

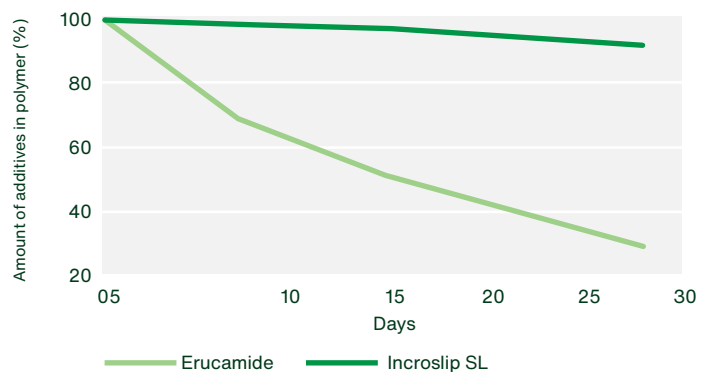


Scratch and scuff protection

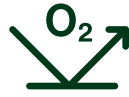


Enhanced mold release properties

1. The amount of slip additive present in unstabilized LDPE after accelerated aging at 50 °C in air.



What makes Incroslip™ additives superior?



High oxidative stability



Excellent organoleptic properties



Low visible bloom



Reduced tackiness



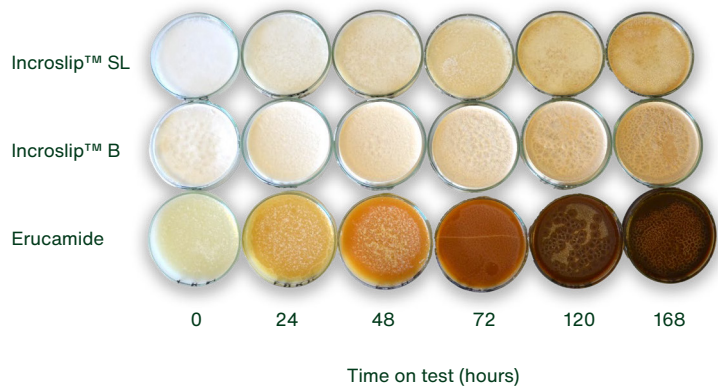
Unparalleled color stability

Incroslip™ SL and Incroslip™ B products show improved color stability compared to standard grade erucamide over 168 hours at 120 °C, as shown in figure 2.

What does this change in color mean?

- Less yellowing indicates less oxidation
- Lower color of finished product
- Fewer oxidative by-products
- Less demand on anti-oxidants

2. Oxidative stability of Incroslip™ SL and Incroslip™ B products vs. erucamide at 120 °C.



Incroslip™ range

Product information

Trade name	Physical form at 25 °C	Primary effect	Application	Comments	Bio-based carbon content*
Incroslip™ SL	Bead	Slip, anti-scratch, torque release	Film, caps, packaging and automotive	For use when the ultimate in high slip and stability is required	100%
Incroslip™ C	Powder/ Bead	Torque release	Caps & closures	For use when high slip is required with good organoleptic properties	100%
Incroslip™ G	Bead	Mold release anti-scratch	Automotive	For use when high stability is required	100%
Incroslip™ B	Bead	Torque release	Caps & closures	For use when high stability is required	100%

*Calculated or tested according to ASTM D6866 / EN 16640

It is recommended that our Incroslip™ products are added via masterbatch or compound to ensure optimized dispersion and accurate dosing.



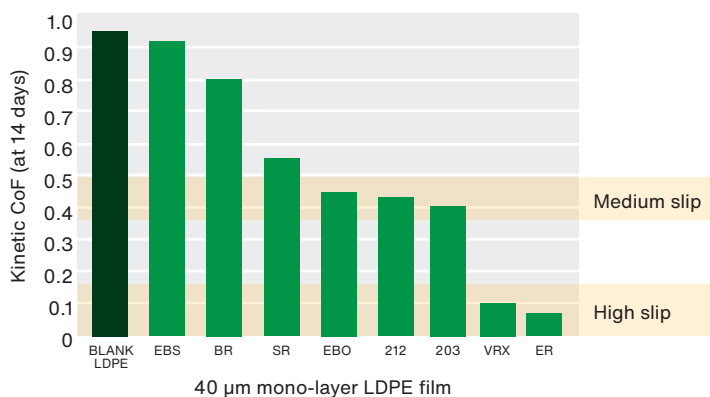
Film & sheet applications

Slip

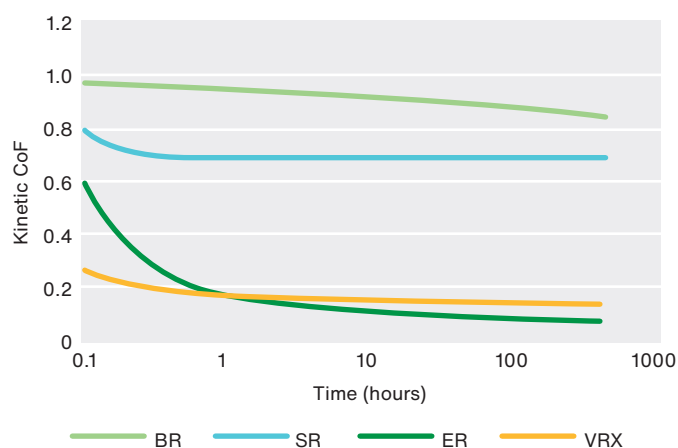
The Optislip™ range offers various levels of slip performance, both in the initial development of slip and in the final slip characteristics, depending upon the application requirements, as shown in figures 3 and 4.

Secondary amides have a higher molecular weight than primary amides, and are less polar, allowing greater control over the slip properties of the film. For polyolefins, medium slip of 0.3-0.5 CoF can be achieved with far lower variability than with primary amides.

3. Comparative effects of Optislip range on coefficient of friction in LDPE (40 µm blown film, all additives at 1000 ppm)

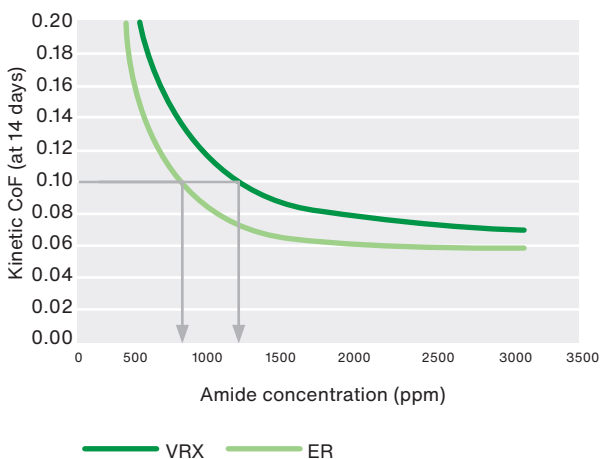


4. Comparative effects of primary amides on the slip (CoF) of LDPE vs time (35 µm blown film, all additives at 500 ppm)

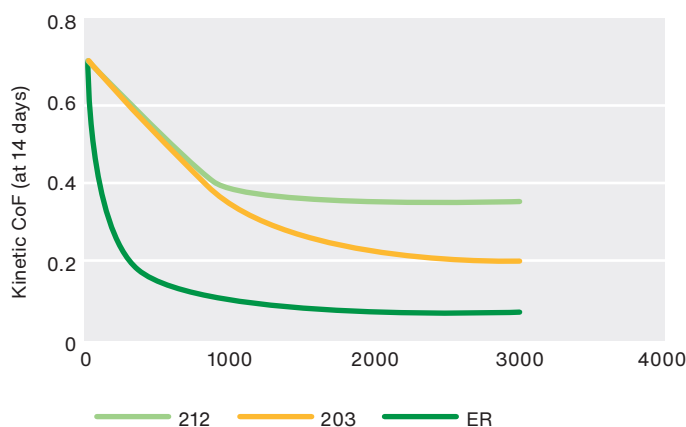


The use of a secondary amide such as Optislip™ 203 or Optislip™ 212 additives can also enhance the printability of film surfaces due to the lower level of slip additives present at the surface. In multilayer/laminated films stable CoF levels may be achieved with secondary amides as they are far less likely to migrate into adjacent polar layers.

5. Comparative effects of Optislip ER & Optislip VRX additive concentrations on the slip (CoF) of LDPE (35 µm blown film)



6. Comparative performance of Optislip 203 & Optislip 212 medium slip additives in LDPE (35 µm blown film, various concentrations)



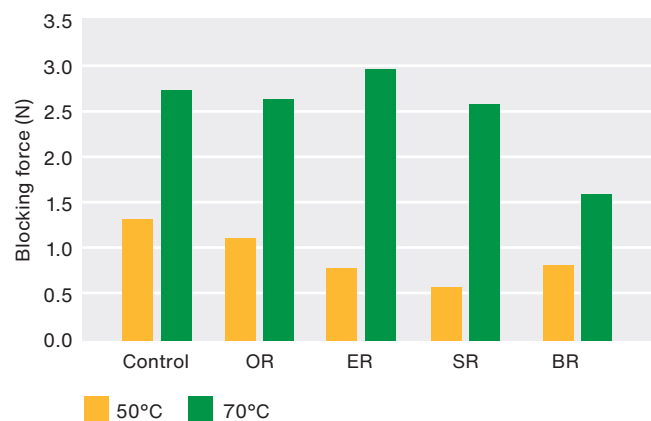
Anti-block

The majority of Optislip™ additives enhance anti-blocking performance when used in combination with inorganic agents. Among them, Optislip™ BR additive is the most effective—migrating to the surface to form a continuous, non-stick layer. This enables the use of lower levels of inorganic anti-blocking agents, resulting in improved film clarity. Additionally, Optislip™ BR additive can be combined with Optislip™ ER additive to deliver both slip and anti-block benefits without increasing the total amide content.

Figure 7 shows induced blocking whereby two pieces of film are placed together between two pieces of glass (100 x 100 mm) with a load of 7 kg. The samples are held at 50 °C or 70 °C for 24 hrs, cooled to room temperature for 24 hrs, and the force required to separate the two layers tested according to ASTM D3354. It can be seen that at 50 °C Optislip™ ER additive gives quite a good anti-block performance, but Optislip™ SR additive is best overall. However, when the temperature is increased to 70 °C, only Optislip BR additive gives a good result.

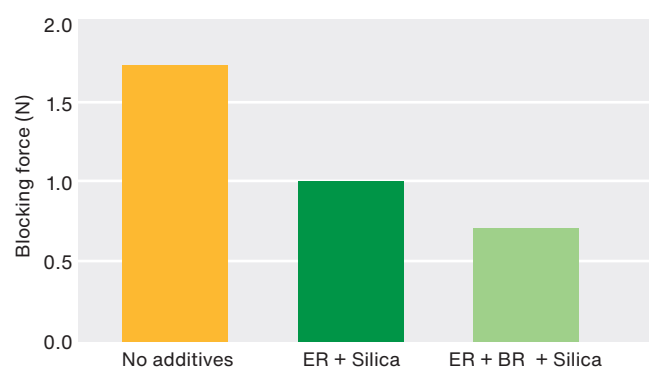
While amides alone can provide effective anti-blocking in film, we recommend supplementing with organic anti-blocking agents to reduce—rather than fully replace—inorganic content. The inclusion of an inorganic anti-block gives time for the organic anti-block to migrate to the surface.

7. Comparative blocking performance of primary amides in LDPE at high temperature (40 µm blown film, 1000 ppm amide)



Optislip BR additive can be used in combination with Optislip ER additive, without increasing the total amide level, to give combined slip and anti-block performance (figure 8).

8. Performance of Optislip ER & Optislip BR additives in combination with inorganic anti-block additive in coPP (30 µm cast film, 2000 ppm total amide content & 1000 ppm silica)



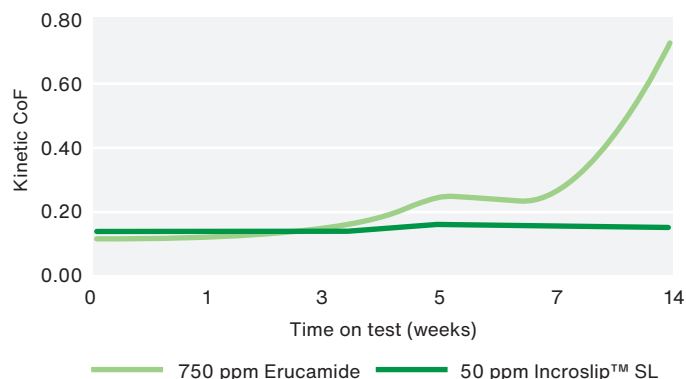
Long lasting slip & anti-block

Incroslip™ products are suitable for both food packaging and non-food grade films, helping to reduce friction during processing, enhance convertibility, and improve end-use performance. This is achieved through superior slip and anti-block performance. Incroslip™ SL additive demonstrates equivalent slip performance to standard grade erucamide in the week following extrusion. After exposure to heat and natural light over 14 weeks, the slip performance of erucamide falls drastically, whereas Incroslip SL additive retains constant performance, as shown in figure 9. Incroslip SL additive has even been shown to retain slip performance for up to four years. In polypropylene films, Incroslip SL additive outperforms standard grade erucamide when subjected to strong UV light over 7 days.

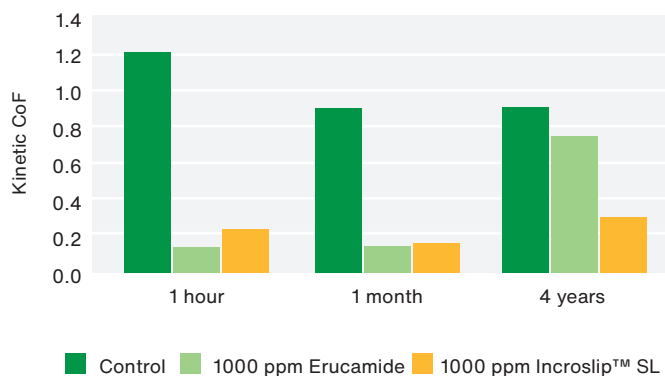
Erucamide quickly breaks down and loses slip performance, whereas Incroslip SL additive maintains high slip until the point that the film itself starts to degrade. We recommend that Incroslip SL additive is used in combination with an anti-blocking additive, such as silica or talc, to ensure optimum performance in film applications.



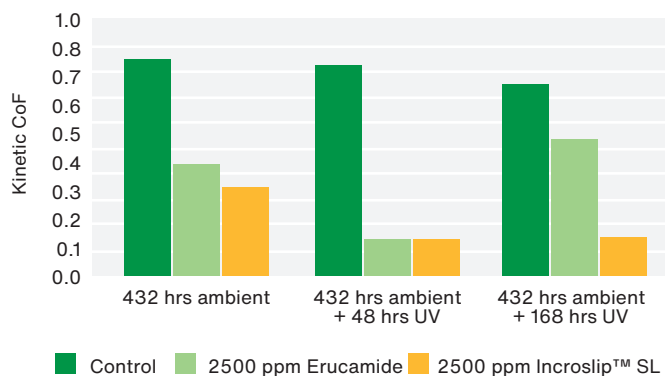
9. Comparison of kinetic CoF of Incroslip™ SL and erucamide in 35 µm LDPE blown film after exposure to natural UV light



10. Kinetic CoF of Incroslip™ SL and erucamide in LDPE blown films after exposure to natural light over 4 years



11. Kinetic CoF of Incroslip™ SL and erucamide in hPP cast film after exposure to accelerated aging in a UV cabinet at 50 °C



Injection molding applications

Optislip™ additives applications

Most Optislip additives will improve blocking when used in combination with inorganic materials. Optislip BR additive is the most effective, migrating to form a continuous non-sticking layer. This allows lower levels of inorganic anti-blocking agent to be used, resulting in improved clarity. Optislip BR can be combined with Optislip ER to deliver both slip and anti-block performance without increasing the total amide level.

Incroslip™ additives applications

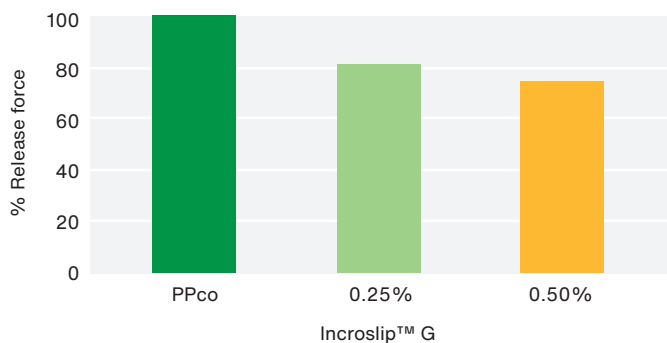
Incroslip™ additives are engineered to enhance mold release and surface quality in polyolefin molded parts. By reducing the coefficient of friction, they deliver measurable improvements throughout the molding process:

- **Reduced processing temperature and pressure**
- **Less wear on ejection systems**
- **Improved surface quality**
- **Fewer rejects and less waste**
- **Better pigment dispersion**
- **Improved stability**
- **Reduced tack and odor**

Figure 12 shows the benefits of using Incroslip™ G additive at different concentrations to reduce the mold release force in polypropylene parts.



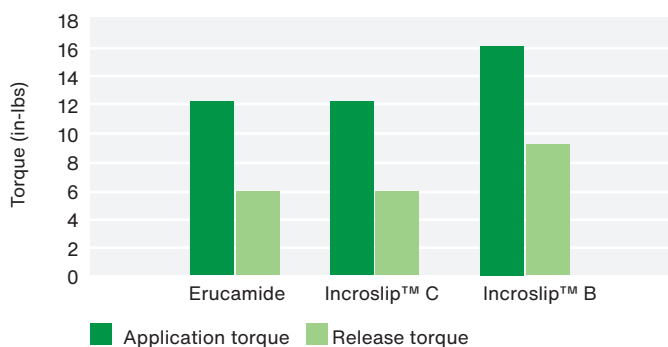
12. Reduction in mold release force of Incroslip™ G in PP parts at various addition levels



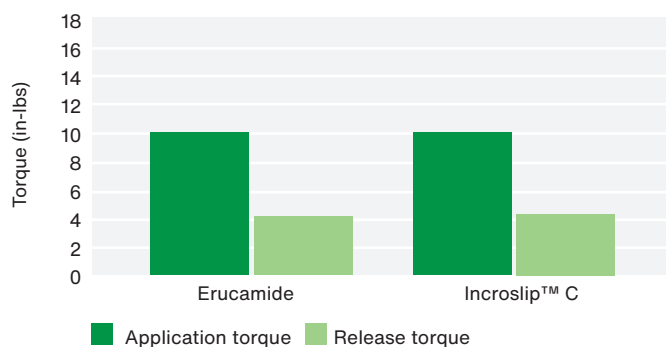
Application and release torque

The Incroslip™ high stability additive range demonstrates improved application and release torque in both PP and HDPE caps and closures, as shown in figures 13 & 14.

13. Torque release - Injection molded PP, one piece closure against PET neck

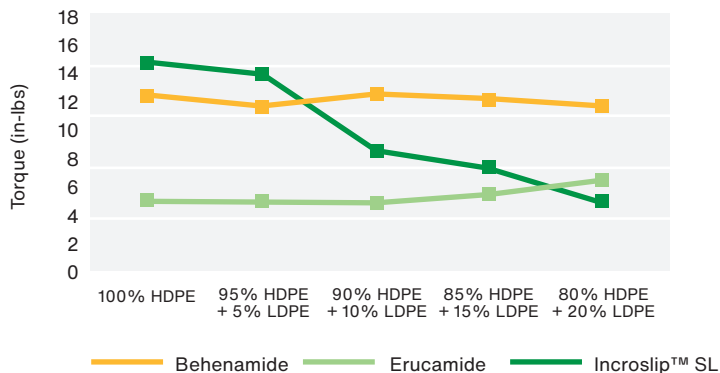


14. Torque release - Injection molded HDPE, one piece closure against PET neck

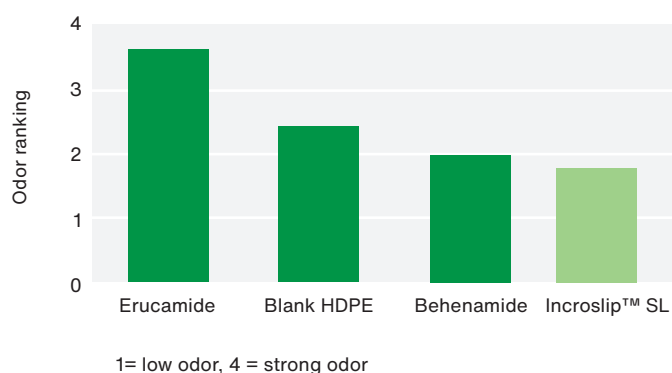


For ultimate stability in cap and closure applications, we recommend Incroslip™ SL additive. The performance of Incroslip™ SL additive can be optimized to achieve the desired combination of torque and stability, as shown in figure 15.

15. Release torque of HDPE caps containing Incroslip™ SL, behenamide and erucamide at different densities



16. Odor tests comparing Incroslip™ SL, behenamide and erucamide to blank HDPE





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