

Ingenia Flexible Packaging Brief

Slip Masterbatch – Why Use it?

Films made from polyethylene/polyolefins exhibit a high Coefficient of Friction (CoF). This makes handling/conversion of the films difficult due to the tackiness of the surface and the inability of the films to slide over themselves and packaging equipment surfaces. The tackiness of the films is reduced by introducing slip agents. Slip agents are materials which act at the surface of the film or object to reduce the friction between it and another surface, thereby reducing CoF.

Slips are usually organic compounds - unsaturated fatty primary amides, which function by migrating to the surface of the polymer product, where they provide lubrication. The slip agent is incorporated into the molten polymer through the melt extrusion process. This slip agent is uniformly distributed in the molten polymer until it reaches the limit of its solubility. Once the molten polymer cools down the slips become less soluble and start migrating to the surface. CoF of the film is tested using ASTM D-1894. The migration of slip is time dependent (Figure 1)

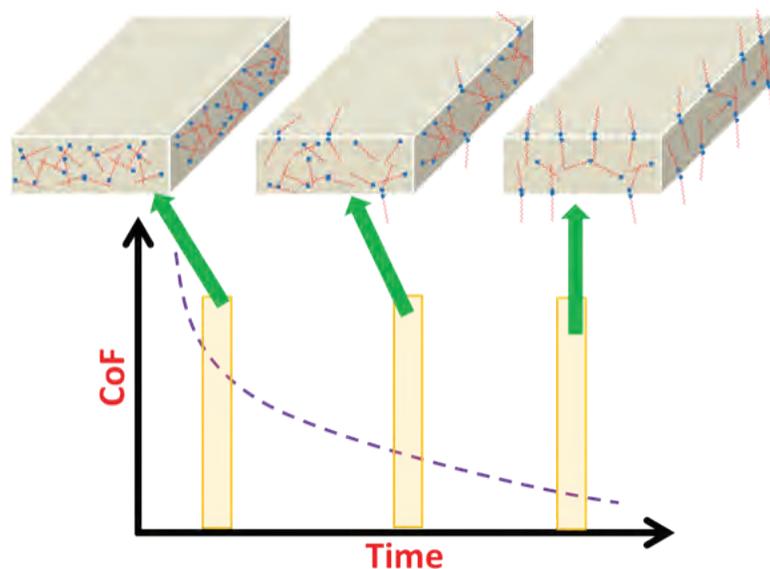


Figure 1: Schematic showing the migration of slip additives from the bulk of the polymer film to the surface of the film, and the associated reduction in CoF.

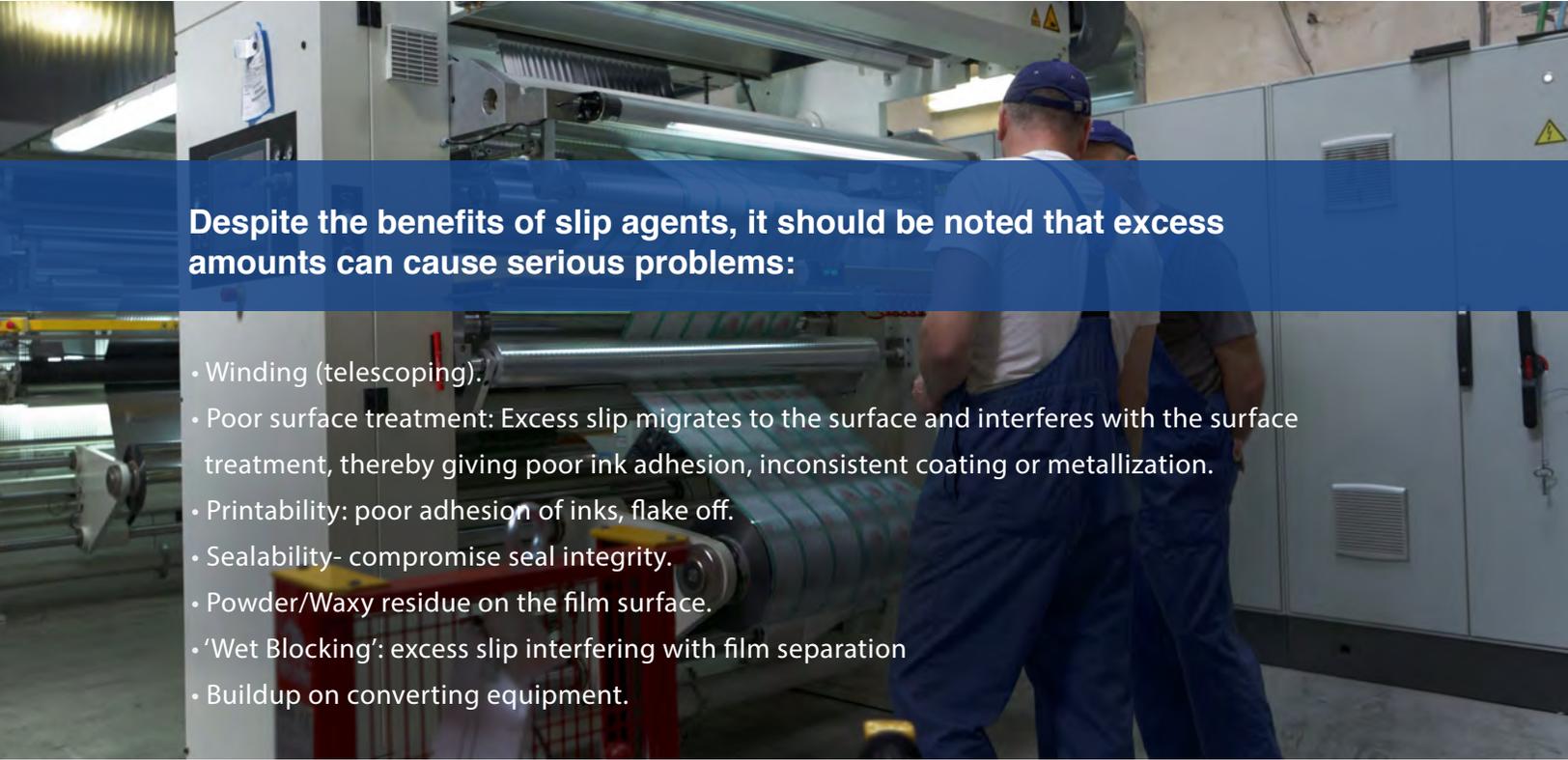


Slips and Antiblocks are synergistic, they help each other – the slip agents provide lubricity thereby, reducing friction, while the antiblocks roughen the surface reducing the friction. The use of slips facilitates conversion- bag making, pouch making, printing etc.

The two most common types of slip used are Erucamide and Oleamide. Erucamide has a longer chain of carbon atoms (C22), while Oleamide has a shorter chain (C18). Erucamide is commonly known in industry as 'Slow Bloom'. Typically, Erucamide is used for off line conversion applications. Oleamide is commonly known in industry as 'Fast bloom'. Fast bloom slip is usually used for in line conversion – inline bag making, immediate printing etc.

The following factors affect the migration of slip agents;

- Polymer used – density, add-pack (additives in the resin). Migration is slower in HDPE, because of the crystallinity and less amorphous portion limiting the mobility of the slip agent.
- Type of slip used- Fast bloom or slow bloom.
- Migration of slip is time dependant, most of the migration is within 24 - 48 hours.
- Processing temperature- higher the temperature greater the migration, but volatilization will occur, greater volatilization with Oleamide, lesser with Erucamide, therefore, even if greater migration occurs surface slip content may be low.
- Ambient temperature – Higher the temperature, greater the migration.
- Film Thickness- Thicker the film, less slip required due to more slip in the matrix vs same surface area.
- Layer composition- Tie Layers tend to attract slips, due to their amorphous structure.
- Storage temperature- Higher the temp, higher the migration, until surface is saturated. Greater the winding tension, slower the diffusion.



Despite the benefits of slip agents, it should be noted that excess amounts can cause serious problems:

- Winding (telescoping).
- Poor surface treatment: Excess slip migrates to the surface and interferes with the surface treatment, thereby giving poor ink adhesion, inconsistent coating or metallization.
- Printability: poor adhesion of inks, flake off.
- Sealability- compromise seal integrity.
- Powder/Waxy residue on the film surface.
- 'Wet Blocking': excess slip interfering with film separation
- Buildup on converting equipment.

In certain applications, the necessary period of time for conditioning after extrusion makes it difficult to consistently reach target COF values. This is due to variation in migration rate with different film resins, varying environmental conditions, and/or interactions with other additives including antifogs, antistats and antiblocks. In addition, traditional amides have poor thermal stability and can negatively impact corona treatment and lamination processes. Permanent slip agents provide immediate COF with minimal variation, there is no migration necessary. The permanent slip agent is part of the matrix and is present at the surface of the film. The required loading in the films are higher and the costs are greater, thus a thin surface layer is typically employed in multi-layer film extrusion to minimize the quantity of permanent slip agent required in the overall film structure.

Other Uses of Slip Agents

Slip agents are also used as mold release agents in molded applications.

Slip agents are used as torque reduction agents in bottle caps to allow for easier cap application after bottles are filled.

In Summary

Slip type, loading level and carrier resin are all factors to consider when using a Slip MB to modify surface characteristics of polyolefin films. The timing of downstream converting processes is another key consideration.

Ingenia has the experience and know how to recommend the optimal slip agent MB for your packaging applications. With a variety of stock and specialty Slip MB products, the solution is available at Ingenia.