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SLIP & ANTIBLOCK PRODUCTS

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E-mail: sales@wellsplastics.com Tel: +44 1785 817 421 Fax: +44 1785 816 357

Wells Plastics Ltd
Emerald Way,
Stone Business Park
Stone, Staffordshire
ST15 0SR
United Kingdom

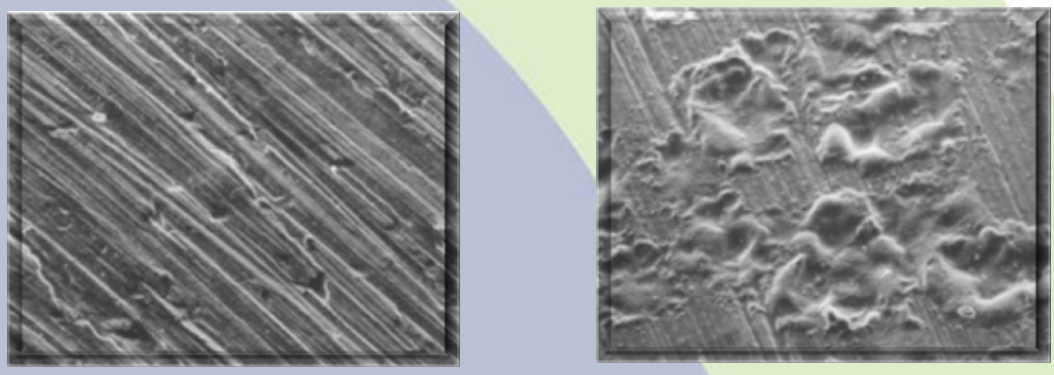
Antiblocking Additives

Polyolefin and other plastic films have a tendency to adhere together, often making it difficult to separate layers. This adhesion between film layers, called blocking, is an inherent property of some polymers. Antiblocking additives can be added to the plastic to minimise this adhesion and so lower the blocking force between layers. Once compounded into a plastic these additives create a micro-rough surface which reduces the adhesion between film layers and lowers the blocking tendancy.

Two factors determine the antiblocking effect:
Number of particles of antiblock at the film surface.
Size of the antiblock particles.

The greater the concentration of antiblock present then the rougher the film surface produced. However it is important that the particles are well dispersed as agglomerates reduce antiblocking performance. Conversely the coarser the particles the further the two film layers are kept apart.

Figure 1: SEM Micrographs of polymer film, Mag x100, 30° Tilt



Control Film | Film containing a silica antiblock

Types of Antiblocks

The choice of antiblock depends upon the polymer being used and the quality requirements of the end product.

The types available include:

Synthetic Silica

This is an amorphous form of hydrous silicon dioxide with high microporosity, a hydroxylated surface and a high surface area. Synthetic silica is used in high quality films and as it has a refractive index close to that of PE and PP it is possible to produce films with high transparency and clarity.

Limestone

This is a naturally occurring mineral mainly consisting of calcium carbonate together sometimes with magnesium carbonate depending on the deposit. It tends to be used as an anti-block in lower quality film applications.

Natural Silica

Natural silica is a sedimentary rock composed of the skeletons of single celled diatoms. The skeletons are made of amorphous silica and have a wide range of porous structures and shapes. Impurities such as water and organics can easily be removed, however the removal of quartz is more complex so natural silicas tend to contain differing levels of quartz depending on the deposit.

Talc

Talc is a magnesium hydrosilicate. It has very low hardness and a refractive index close to that of PE and PP. Deposits are found around the world and although it contains certain levels of impurities these can be minimized through refining.

Zeolites

These are crystalline, hydrated alumosilicates. They have extremely uniform, three dimensional porous structures and again a refractive index close to PE and PP. Zeolites occur as natural minerals or can be synthesized, however their use as antiblock additives is small

Organic Additives

Certain organic materials such as hard waxes and fatty acid amides show antiblocking effects. Compared to inorganic additives they have low antiblocking efficiency but excellent slip effect. Often slip and antiblock additives are used together to provide the optimum balance between slip and antiblock performance.

Slip Additives

Polyolefin films tend to adhere to themselves and metal surfaces due to their high coefficient of friction (COF). For processing ease, films need a COF near 0.2. Slip additives can modify the surface properties of a film and thus lower the friction between film layers and other surfaces. To be effective the slip needs to migrate out of the polymer to the surface and therefore it must have a degree of incompatibility with the polymer.

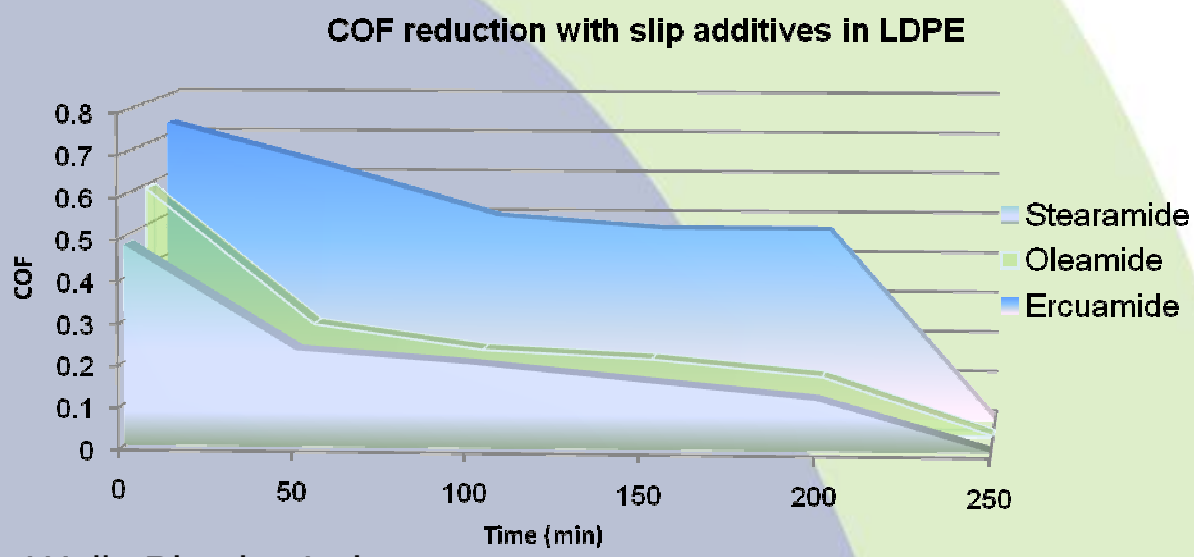
Fatty acid amides are often used as slip additives. During processing they are solubilized in the amorphous melt, but as the polymer cools and crystallises the fatty acid amide is “squeezed” out forming a lubricating layer at the polymer surface. The addition of a slip additive can prevent film sticking and pulling helping to increase throughput.

Types of Slip Additive

The most commonly used slip additives are erucamide (C-22) and oleamide (C-18). Oleamide migrates quicker than erucamide and is often called “fast blooming”. However after a certain time the slower erucamide will provide films with a lower COF than oleamide. Erucamide, with its lower vapour pressure and volatility, is used in higher temperature processing applications and it also stays at the surface longer, not venting off as smoke. Oleamide is used where a low COF is needed in a short period of time, while the slower migration of erucamide can be advantageous in roll stock applications and on-line corona treatment. Another fatty acid amide is Stearamide. This is often used together with erucamide or oleamide to provide an anti-blocking effect when film transparency is very important.

The concentration of slip present affects performance. Initially the COF is sensitive to small variations in concentration until a critical level of slip is reached, after which further slip has little effect on the COF. The amount of slip required depends upon film thickness, the slip additive being used and the presence of other additives such as anti-blocks.

Figure 1: The effectiveness of different slip additives at 0.1% in LDPE



Wells Plastics Ltd

Wells has many years of experience in developing the correct formulation for precise requirements and we are able to either offer a product from our large range of standard grades or produce a carefully formulated “special” to meet even the most demanding application.