

FERRO-PLAST s.r.l.

Crodamide™ slip & anti-block
for easier processing & handling of polyolefins



CRODA
Polymer Additives

At the heart of better plastics

Easier processing & handling of polyolefins

Polymer surfaces often exhibit high friction leading to problems during manufacture and use. High friction can result in difficulties with:

- Winding of film rolls
- Bag production
- Packaging operations
- Mold release

Crodamide™ slip & anti-block agents

Croda Polymer Additives produces a range of slip and anti-block agents which are incorporated directly into the polymer during the extrusion process. They work by migrating to the surface as the polymer cools forming a solid lubricating layer at the surface, lowering the friction, or reducing adhesion between contacting polymer surfaces and the polymer and other materials.

Product range

The Crodamide range includes a wide variety of primary amides, secondary amides and secondary bis-amides for use as slip and anti-block agents in plastics.

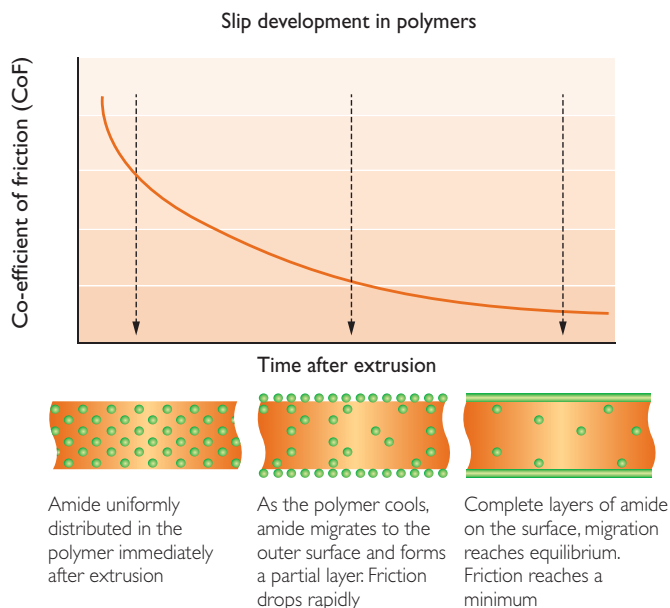


Figure 1: How Crodamide slip agents work

Product	Description	Physical form at 25°C	Recommended uses
Crodamide E	Erucamide	Bead	Mold release in technical applications
Crodamide ER	Refined erucamide	Bead/Microbead/Pastille/Powder	Slip in polyolefins, also PVC and many other polymers
Crodamide VRX	Refined vegetable oleamide	Bead/Powder	Slip in polyolefins, also PVC and many other polymers
Crodamide OR	Refined oleamide	Microbead/Pastille	Slip in polyolefins, also PVC and many other polymers
Crodamide ORX	Refined oleamide	Microbead/Pastille	Slip in polyolefins, also PVC and many other polymers
Crodamide S	Stearamide	Bead/Powder	Anti-block in polyolefins
Crodamide SR	Refined stearamide	Bead/Powder	Anti-block in polyolefins
Crodamide SRV	Refined vegetable stearamide	Bead/Powder	Anti-block in polyolefins
Crodamide BR	Refined behenamide	Bead	Anti-block in polyolefins
Crodamide 203	Oleyl palmitamide	Bead	Medium or controlled slip in polyolefins, especially useful in laminated or co-extruded structures. Also slip in ionomers and other ethylene copolymers
Crodamide 212	Stearyl erucamide	Bead	Medium or controlled slip in polyolefins, especially useful in laminated or co-extruded structures. Also mold release for engineering polymers
Crodamide EBS	Ethylene bis-stearamide	Microbead/Powder	Anti-block in polyolefins and process aid to improve dispersion of fillers. Also mold release in nylon and ABS, and lubricant for PVC
Crodamide EBSV	Vegetable ethylene bis-stearamide	Bead/Powder	Anti-block in polyolefins and process aid to improve dispersion of fillers. Also mold release in nylon and ABS, and lubricant for PVC
Crodamide EBO	Ethylene bis-oleamide	Bead	Medium slip and anti-block in polyolefin polar copolymers. Especially useful as a pellet anti-tack in EVA hot melt adhesives
Crodamide DD8001	Proprietary blend	Bead	Release agent for rubber

Applications

Slip

Crodamide products are effective at low levels, providing a cost-effective solution to friction related constraints in film production, conversion, and closure release applications.

The 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.

Erucamide and oleamide are the most commercially important slip additives. It is generally considered that oleamide blooms to the surface faster, thus providing quicker slip development. The advantages of erucamide over oleamide include lower volatility, superior colour and heat stability, improved organoleptic properties, better blocking performance over similar formulations containing oleamide, and a lower final co-efficient of friction.

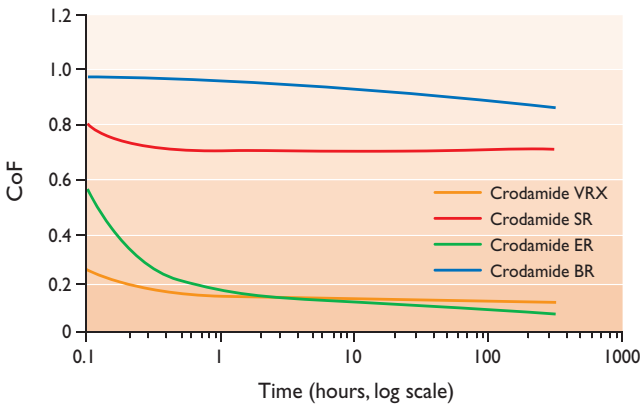


Figure 2: Comparison of the effects of primary amides on the slip (CoF) of LDPE

Polyethylene

In LDPE, Crodamide ER provides a lower co-efficient of friction with a lower addition level compared to Crodamide VRX.

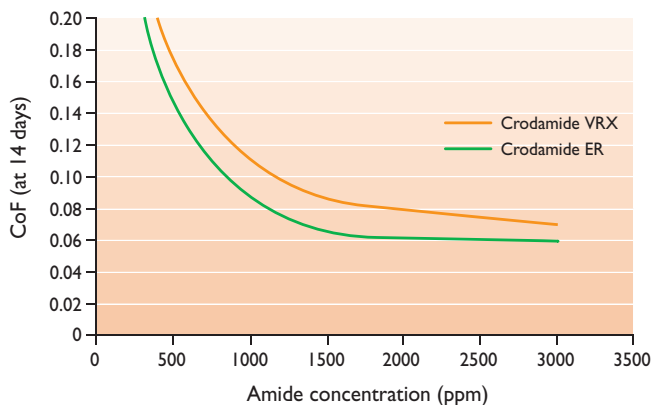


Figure 3: Comparison of the effects of Crodamide ER and VRX concentrations on the slip (CoF) of LDPE

Crodamide ER is recommended in LLDPE due to its excellent heat stability and lower volatility. Usage levels in LLDPE are typically higher than in LDPE.

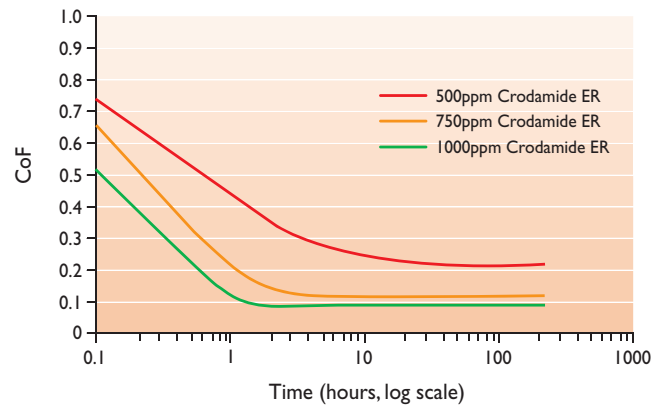


Figure 4: Comparison of the effects of Crodamide ER concentration on the slip (CoF) of LLDPE (which contains 3000ppm natural silica anti-block)

Polypropylene

Crodamide VRX is significantly faster migrating in hPP compared to Crodamide ER, however; Crodamide ER shows good migratory performance in coPP. Often blends of Crodamide ER and VRX are used to optimise overall performance.

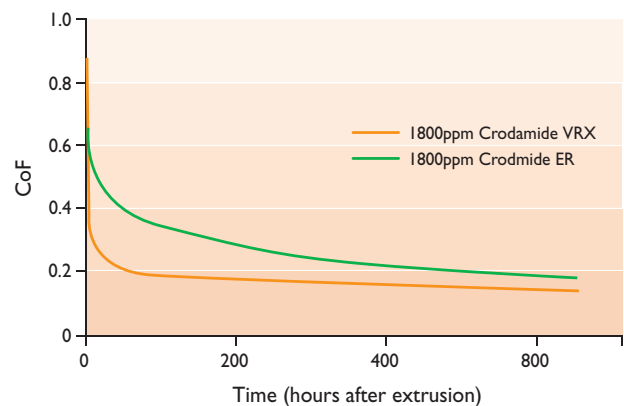


Figure 5: Comparison of the effects of Crodamide ER and VRX on the slip (CoF) of hPP (which contains 1800ppm silica)

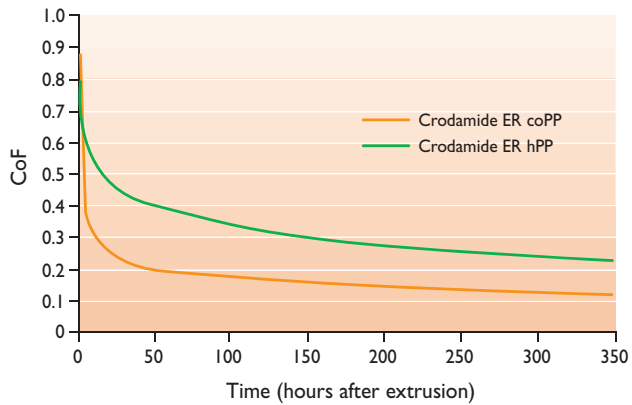


Figure 6: Comparison of the effects of Crodamide ER on the slip (CoF) of coPP and hPP (which contains Crodamide ER and synthetic silica at 1800ppm each)

Medium slip

Crodamide 203 and 212 offer controllable medium slip performance where a co-efficient of friction of 0.3 to 0.4 is desired. They allow precise control at reasonable addition levels, particularly in co-extruded laminated structures.

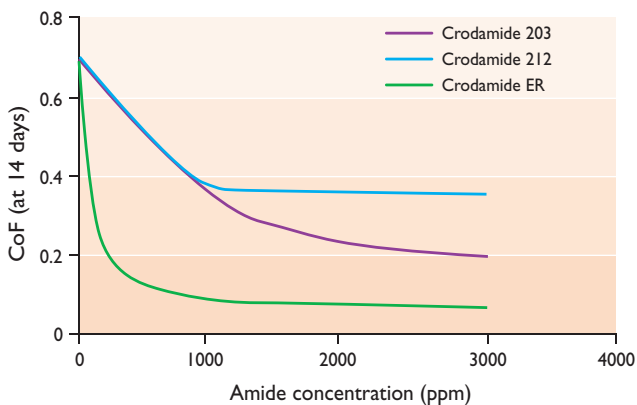


Figure 7: Performance of Crodamide 203 and 212 as medium slip additives in LDPE film

Anti-block

Most Crodamide additives will improve blocking when used in combination with inorganic materials. Crodamide BR 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. Crodamide BR can be used in combination with Crodamide ER, without increasing the total amide level, to give combined slip and anti-block performance.

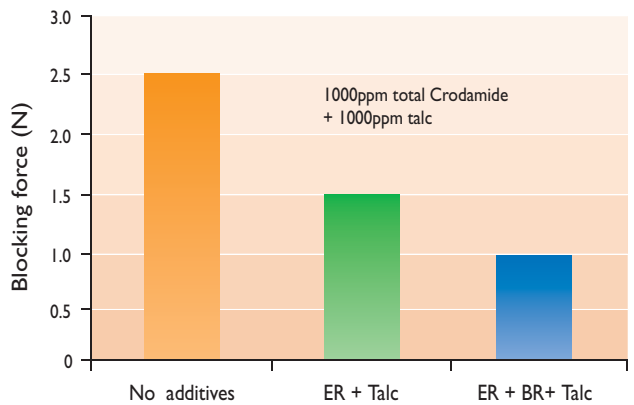


Figure 8: Performance of Crodamide ER and BR in combination with inorganic anti-block additive in LLDPE film

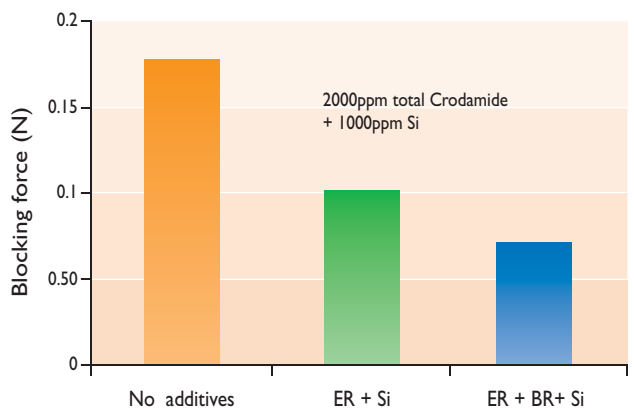


Figure 9: Performance of Crodamide ER and BR in combination with inorganic anti-block additive in coPP film

Injection molding

In molding operations Crodamide products migrate rapidly to the polymer/mold interface where they provide easier and more uniform mold release. They eliminate the need for mold release sprays and give a better surface finish and reduced pin marking.

Further downstream benefits include:

- Better control of applications and release torque of closures
- Ease of assembly
- Easier conveying of moldings
- Improved scratch resistance
- Improved packing density of molded parts
- Improved de-nesting performance

For further details of our injection molding process aids for polystyrene and polyesters please see IncroMold, IncroMax PET 100 and IncroMax PS brochures.

Thermal stability of the Crodamide range

Based on the graphs below it is suggested that oleamides and stearamides are used up to 230°C, erucamides and behenamides are used up to 260-270°C and secondary amides may be used up to and in excess of 300°C.

These recommended maximum processing temperatures are for guidance only and alterations may be necessary to compensate for residence time during processing.

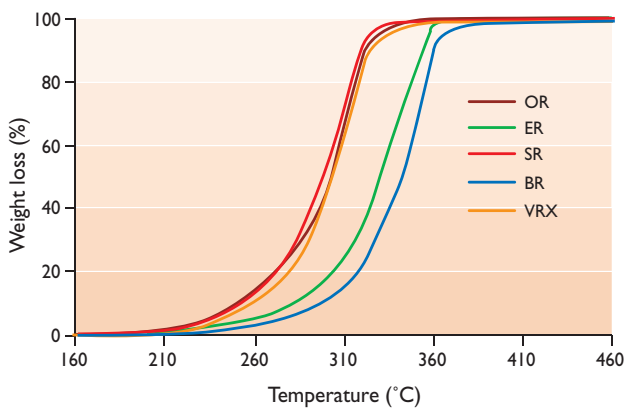


Figure 10: Thermogravimetric analysis of Crodamide primary amides

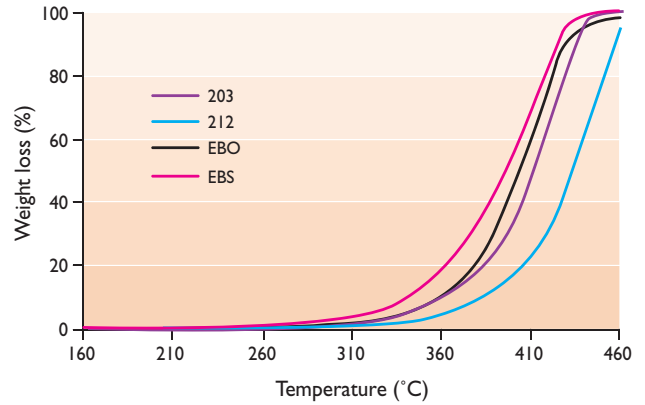


Figure 11: Thermogravimetric analysis of Crodamide secondary amides

Crodamide usage

Crodamides can be added directly to the polymer at the processing stage, pre-compounded or included via masterbatch. Experience has shown that Crodamides can be easily incorporated into the polymer: Simple manual mixing prior to processing will normally give an acceptable dispersion, though mechanical means is preferable. The optimum dosage level depends on the polymer type and the degree of lubrication required.

Recommended addition levels

Croda recommends initial levels of around 500 – 2000ppm in film and 0.2 – 1.0% in molding applications. Croda is among the world leaders in amide technology and can provide technical advice for specialised applications if required.

Technical partnership

Extensive technical service is offered to our customers, supported by our purpose-built plastics application laboratory in the UK. With over 30 years' experience of Crodamide products, our analytical laboratories have international accreditation in the analysis of oil and fat derivatives. Croda is a world expert in the use of fatty acid amides in polymer and related applications. Our experienced technologists can offer you advice on selecting the most effective additive and dosage for a particular application.

Quality standard

The Crodamide range is produced from naturally-occurring oils and fats. Croda is a leading contractor for growing high erucic rape seed oil (HERO) for industrial uses, thereby ensuring continuity of supply of this vital raw material. Croda has two manufacturing facilities for the production of Crodamides, one of which is dedicated to Crodamide production, allowing full integration of processes - from raw material to packaged finished product - on one site.

Croda offers various grades of Crodamide that have been optimised for the demands of individual application areas. The Crodamide range is subject to stringent quality control procedures during and after manufacture; SQC data on key variables can be provided on request.



Further information

Croda sales and distribution are coordinated through an extensive worldwide network of associates and agents. For details of your local representative please contact your nearest Croda regional office.

Visit our global website at www.croda.com/europe/pa

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