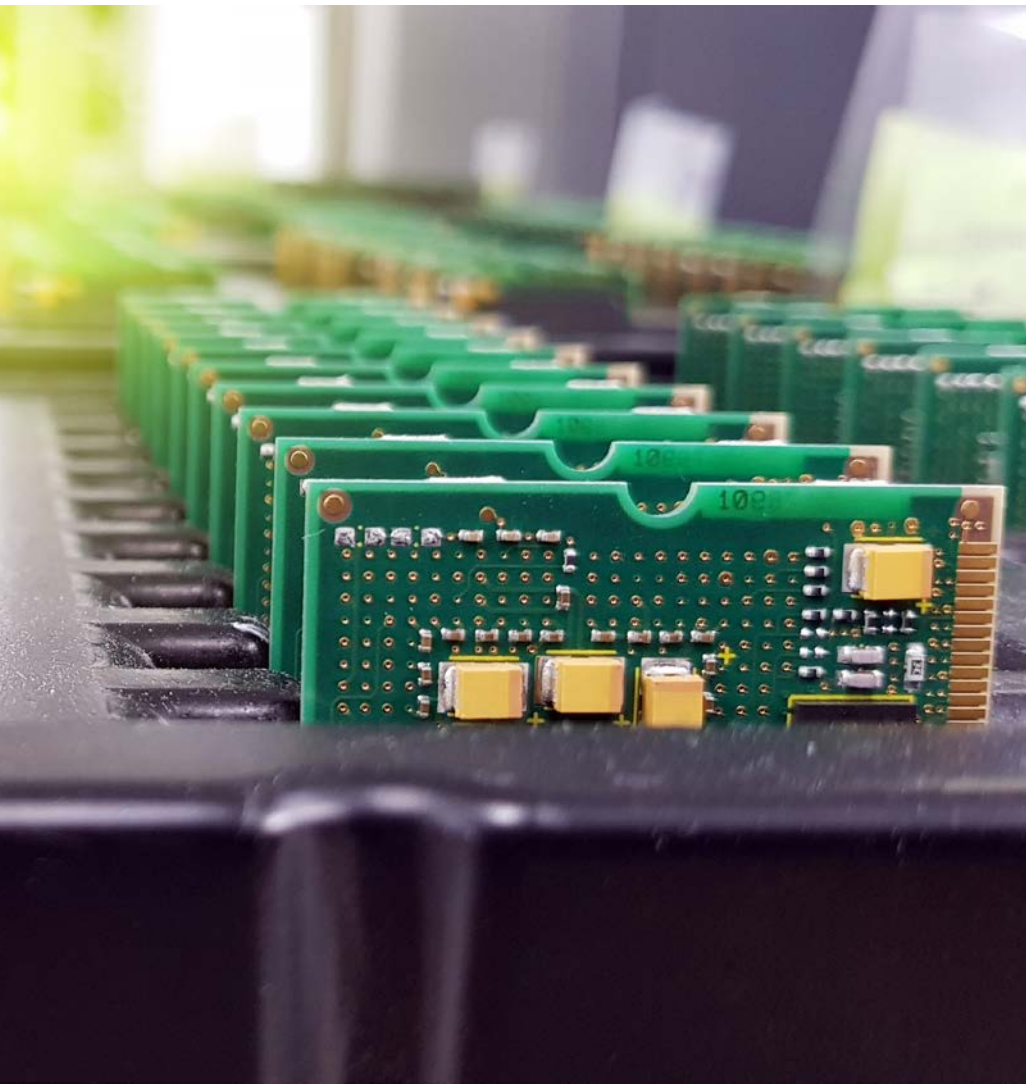
Atmer™ & Ionphase™ Additives



Migrating and Permanent Static Control Additives

Cargill™

Migrating & Permanent Static Control Solutions

Smart solutions for all your static needs; Cargill's Polymer Additives business offers a range of short, medium and permanent anti-static additives for a wide variety of applications.

Polymer Additives by Cargill is a leading global solutions provider of specialty additives that provide a variety of smart effects in a wide range of polymer types and applications.

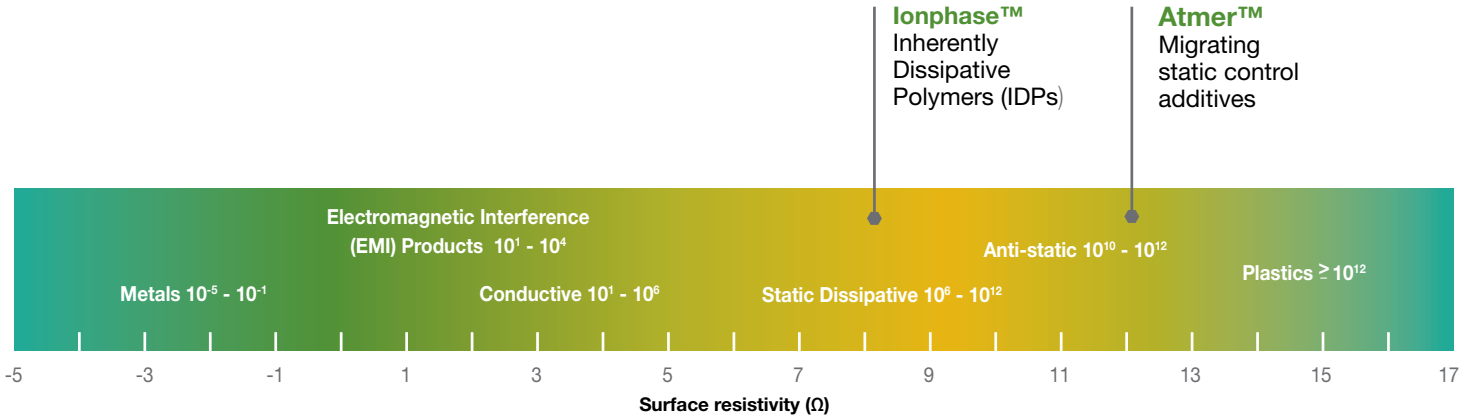
Cargill's range of static control solutions offers different technologies, physical forms and longevity to provide the required static control for different materials and applications.

We can provide guidance on which products best suit your applications, polymer and industry.

What are static control Additives?
Static control additives are added to plastics to reduce or eliminate electrostatic related issues. Electrostatic, which can be shortened to static, is produced by charge separation caused by the movement of one material over another, and this can create many challenges in manufacturing processes and end applications of plastic materials.

Resistivity is a unit of measurement of how strongly a material opposes the flow of current. Static control additives work by lowering the resistivity of a material so that charges are mobile and therefore will not cause static issues such as dust attraction or electrostatic discharge (ESD).

There are many anti-static technologies available that lower resistivity to different levels, depending on the longevity of anti-static protection needed.



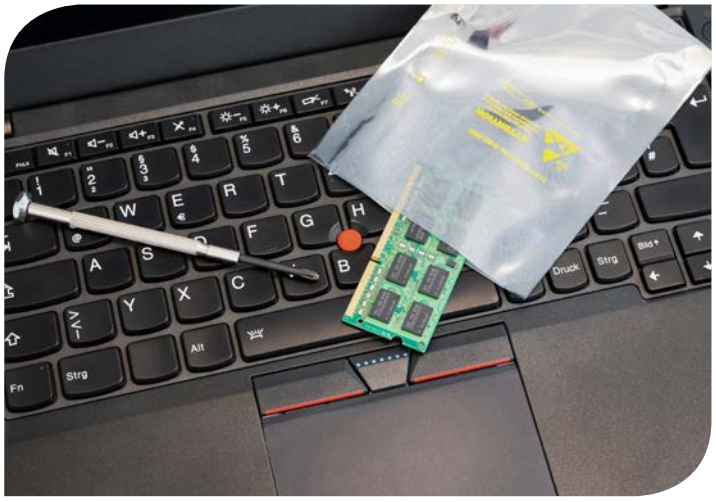
1. *Surface resistivity of comparative anti-static technologies*

Why are static control Additives Needed?

Most plastic materials are insulators and have the tendency for high static build-up. Some examples of the challenges faced due to static build-up in polymers are:

Increased handling and contamination issues during transport, storage and packaging

Dust attraction affecting both appearance and performance of plastic products



Risk of electrostatic discharge that will damage electronic components

Risk of electrostatic discharge causing shocks to employees and even fires or explosions

Industry Standards for Static Protection

For some applications it is important that the plastics and the additives within them meet certain industry standards to ensure the correct levels of static protection are met. Our experts can advise which products to use, how to optimize your formulation and how to test your end product's static performance to meet these guidelines.

Shocks & Explosions (EX)

Risk of electrostatic discharge that could ignite explosive atmospheres such as in automotive paint spraying or in factories handling powders such as flour. There are various global standards and directives, including ATEX in Europe.

Electrostatic Protected Area (EPA)

Required for the manufacture of electronic components to prevent damage from ESD. Standards in the area of EPA include the international standard IEC 61340 and national standards such as ANSI/ESD S20.20.

Electrostatic Attraction (ESA)

ESA causes dust attraction to an object such as cosmetic or food packaging, household appliances or retail displays. There are no known standards relating to ESA at the moment and testing is usually defined by the manufacturing company.

Types of Anti-static Additives

Our anti-static additives can be incorporated into or coated onto plastics to overcome these challenges.
We offer three types of anti-static additive to suit your requirements:

TYPE	LONGEVITY	WHAT ARE THEY?	HOW DO THEY WORK?	WHY CHOOSE THIS TYPE?
Polymeric	Permanent*	Internally incorporated non-migrating static dissipative polymers	They reduce the resistivity of the blend by forming a co-continuous ion conductive phase within the host polymer	For permanent effect in automotive and packaging applications, or where applicable standards need to be met for example EX or EPA
Migrating	Short & medium	Internally incorporated low molecular weight migrating additives	They are incorporated via a masterbatch and migrate to the surface after extrusion where they pick up moisture	For short or medium term performance for example in protective packaging, or where wide ranging food contact approval is needed

Ionphase™ Polymeric Static Control Additives

Ionphase™ Polymeric Static Control Additives are a range of Inherently Dissipative Polymers (IDP), also known as Permanent* Anti-stats, that reduce the surface resistivity of polymers and provide safety and control for static related issues

Key Benefits

- Immediate and permanent effect
- Humidity independent
- Engineered additives give a uniform and homogenous distribution into host polymer.
- Minimal change to host polymer properties
- Good compatibility with host polymer
- Excellent processability and surface quality
- Suitable for compounding, extrusion or injection molding
- Allows compliance with key industry standards for EPA and EX areas

How Do Polymeric Static Control Additives Additives Work?

Polymeric static control additives are based on a high molecular weight polymer that is incorporated into the polymer directly to provide a co-continuous ion network. Ions acting as charge carriers within the additive neutralize charge imbalance and therefore decay the static field. This can be measured as lowered resistivity of the material.

Polymeric static control additives are considered non-migrating and do not move out of the polymer. They therefore provide a permanent effect during the lifetime of the product. They are also humidity independent, and do not rely on atmospheric moisture to provide an effect.

Choosing the Right Ionphase Grade and Addition Level

There are many factors to consider when choosing the right Ion phase grade and addition level, including:

- The end conversion method and final application
- The host polymer used
- The electrostatic performance target

The electrostatic performance target is related to the end application and safety requirements of the polymer Certain applications require specific surface resistivity:

Where EX safety is a priority

1E8 Ω-1E9 Ω

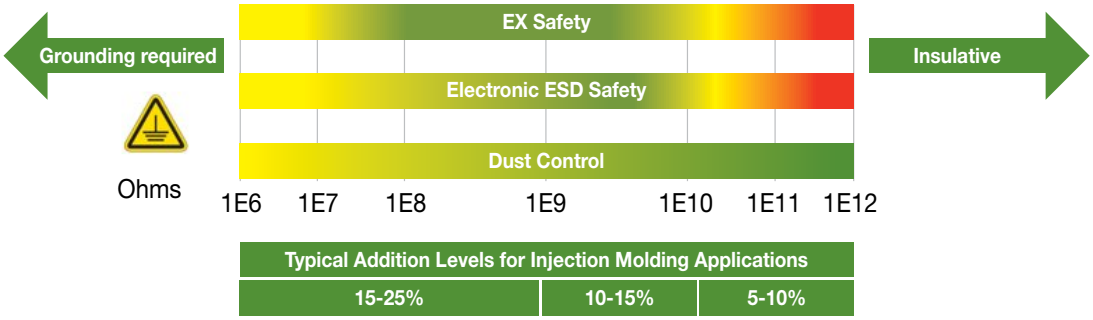
Where ESD protection is required

1E9 Ω-1E10 Ω

Where optimum dust control is wanted

1E10 Ω-1E12 Ω

The level of resistivity can be controlled by varying the addition level as indicated in figure 2.



2. *Surface resistivity requirements for various permanent anti-static additive applications with corresponding typical addition levels*

* "Permanent" is a common description in the industry for the internally incorporated, non-migratory polymeric static control additives. It is used to emphasize the long-lasting permanence and durability of the polymeric static control additive, compared to the migrating type of additive, rather than the meaning of "permanent" literally. Non-migratory polymeric static control additives are based on inherently dissipative polymer technology. It provides electrostatic reduction throughout the product life cycle and therefore, it is usually classed as permanent in the industry.

All references to "permanent" in this article are based on the above explanation.

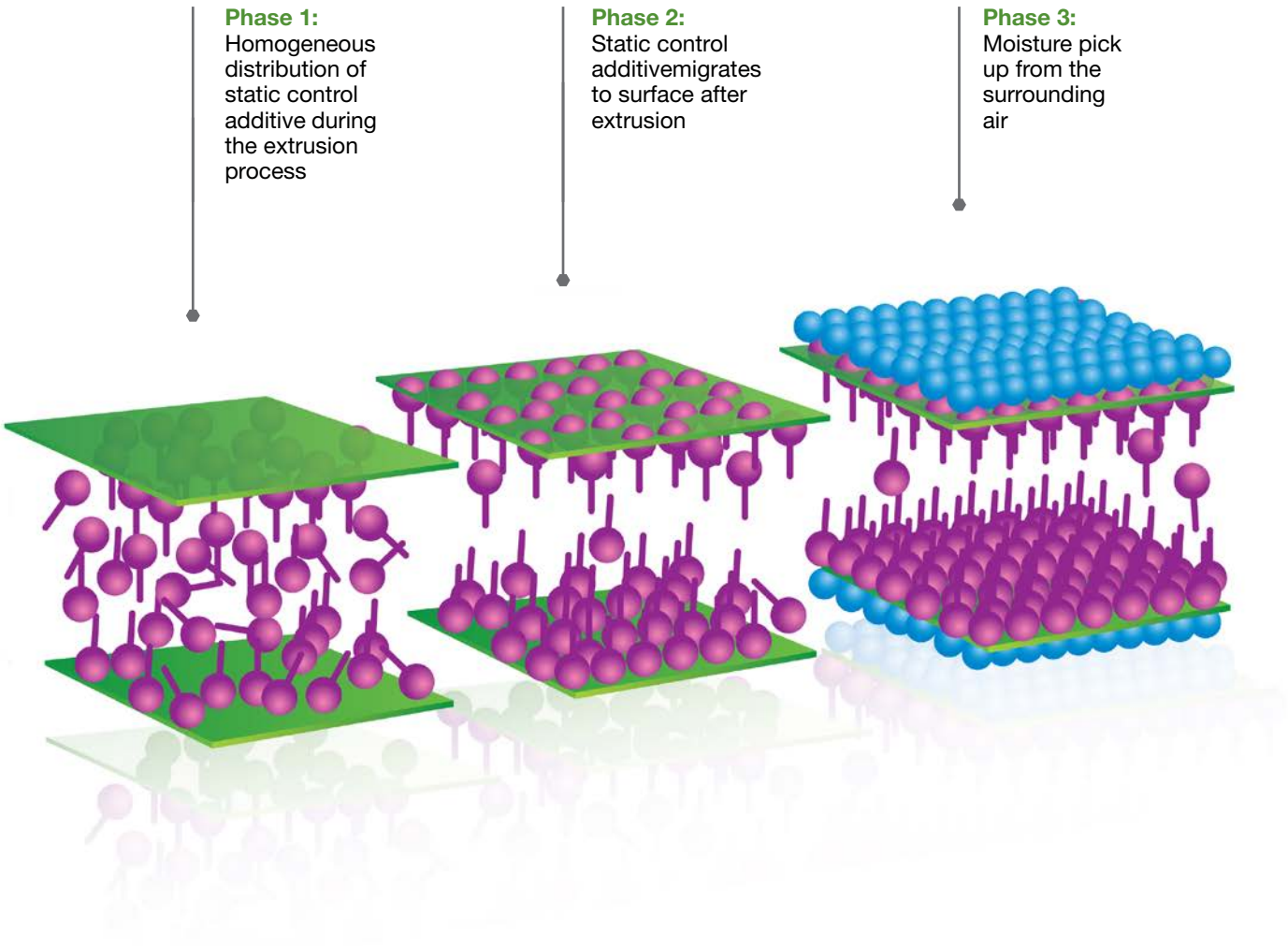
Atmer™ Migrating Static Control Additives

The Atmer™ range of migrating static control additives minimize electrostatic charge buildup in a range of polymers, offering short-term and medium-term performance longevity. These additives are useful for a variety of applications, mostly to reduce dust pick up in plastic packaging, and can be added to polymers as a masterbatch, during compounding or directly during extrusion. The Atmer range of additives are also available as highly loaded concentrates that are easier to dose and have a similar melting point.

How Do Migrating Static Control Additives Work?

Atmer™ additives work by migrating through the polymer matrix towards the surface as it cools. At the surface they pick up moisture from the atmosphere, providing a pathway along which charge can pass to earth.
The plastic material therefore becomes electrically neutral.

4. *Mode of action of migrating static control additives*



Product Listing

There are two types of static control additives to choose from in our range, each suitable for different applications and host polymers.

Polymeric Static Control Additives

Applications
Where EX and EPA standards need to be met, or permanent dust control is required. For example, electronics and chemical packaging, and molding applications such as interior automotive parts and household appliances.

Host polymers
Polyolefins, styrenics, thermoplastic elastomers (TPE) and engineering plastics.

Migrating Static Control Additives

Applications
Cosmetics packaging, food packaging and automotive interior parts.

Host polymers
Polyolefins, PVC, styrenics.

Polymeric Static Control Additives

YOUR POLYMER	PROCESSING		OUR RECOMMENDATION	PHYSICAL FORM T 25 °C	COMMENTS
	EXTRUSION	COMPOUNDING & INJECTION MOLDING			
Polyolefins	✔		Ionphase™ PE0108M	Pellets	Suitable for blown film liners and other extrusion applications. Product has food contact compliancy according to EU 10/2011 regulation.
Polyolefins	✔		Ionphase™ fSTAT series	Pellets	For use in general extrusion applications such as films, bags, liners and thermoformable sheets.
HDPE	✔		Ionphase™ rSTAT series	Pellets	Designed for extrusion blow molding applications (IBCs, drums, canisters).
HDPE, PS, PA12		✔	Ionphase™ U3	Pellets	Suitable for injection molding applications (ATEX, EPA, dust prevention).
PP		✔	Ionphase™ U5	Pellets	Designed for use in colourable, translucent, and filled PP injection molding applications. Examples of end applications are PP electronics packaging, household appliances and automotive parts
ABS, PP	✔	✔	Ionphase™ abSTAT	Pellets	Suitable for thermoformed trays used in electronics industry and for various injection molding applications (ATEX, EPA, dust prevention).
Styrenics (HIPS, GPPS)	✔		Ionphase™ eSTAT2	Pellets	Suitable for thermoformed trays used in electronics industry.
Styrenics (PS, HIPS, ABS), POM	✔	✔	Ionphase™ U2	Pellets	Recommended for thick POM sheets/profiles and various styrenics applications.
mPPO, PPS, PBT, PC		✔	Ionphase™ hSTAT2	Pellets	Recommended for engineering plastics requiring high processing temperatures.
PC blends (PC/ASA, PC/ABS), PMMA, TPU, SEBS	✔	✔	Ionphase™ U1	Pellets	Suitable for various injection molding and extrusion applications such as dust prevention in automotive interior parts and consumer appliances.
PMMA, PLA, PVC	✔	✔	Ionphase™ trSTAT	Pellets	For use in transparent PMMA applications and for low processing temperature polymers.

Migrating Static Control Additives

YOUR POLYMER	OUR RECOMMENDATION	DESCRIPTION	PHYSICAL FORM AT 25 °C	ORIGIN	COMMENTS
100% Active					
HDPE	**Atmer™ 122**	Glycerol ester	Microbead	Vegetable	Suitable where short term static control/ lubrication balance is required.
	Atmer™ 125	Glycerol ester	Microbead	Vegetable	Suitable where short term static control/ lubrication balance is required. Only available for supply in Asia.
	Atmer™ 129 NV	Glycerol ester	Microbead	Non-vegetable	Suitable where short term static control is required.
	Atmer™ 129	Glycerol ester	Microbead	Vegetable	Suitable where short term static control is required.
	Atmer™ 1012	Glycerol ester	Pastille	Non-vegetable	Suitable where short term static control/ lubrication balance is required.
	Atmer™ 1013 NV	Glycerol ester	Pastille	Non-vegetable	Suitable where short term static control is required.
	Atmer™ 1013	Glycerol ester	Pastille	Vegetable	Suitable where short term static control performance is required.
	Atmer™ 262	Ethoxylated amine	Liquid	Vegetable	Suitable for use in polyolefins and styrenics
HIPS, ABS, non-transparent rigid PVC	**Atmer™ 190**	Alkyl sulfonate	Pastille	Synthetic	Only suitable for non-transparent applications.
Concentrates					
Polyolefins	**Atmer™ 7001**	50% concentrate in polypropylene	Pellets	Vegetable	Fast acting, long-lasting static control
	Atmer™ 7002	50% concentrate in polypropylene	Pellets	Vegetable	Offers static control and other mold release benefits. Recommended for use in PP closures
	Atmer™ 7103	50% concentrate in polyethylene	Pellets	Vegetable	A mixture of static control additives to provide a synergistic effect
	Atmer™ 7105	50% concentrate in polyethylene	Pellets	Vegetable	Fast acting, long-lasting static control
	Atmer™ 7300	50% concentrate in polyethylene	Pellets	Non-vegetable	Particularly recommended for use with expanded polyethylene as a process aid. Also offers additional mold release benefits, as well as well as being an effective anti-static additive with wide food contact approvals.
	Atmer™ 7306	40% concentrate in polyethylene	Pellets	Vegetable	Offers additional mold release benefits, as well as well as being an effective anti-static additive with wide food contact approvals.
	Atmer™ 7325	30% concentrate in universal polyolefin carrier	Pellets	Non-vegetable	Mixture of additives to provide a synergistic anti-static effect

Products in this range can be added via masterbatch, during compounding or directly during extrusion

Further Information

Cargill Bioindustrial sales and distribution are coordinated through an extensive worldwide network of technical and commercial experts. For further information or guidance please contact us:

polymeradditives@cargill.com

Cargill Bioindustrial,
15407 McGinty Rd W,
Wayzata, MN 55391.
T *+1 800-227-4455*

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