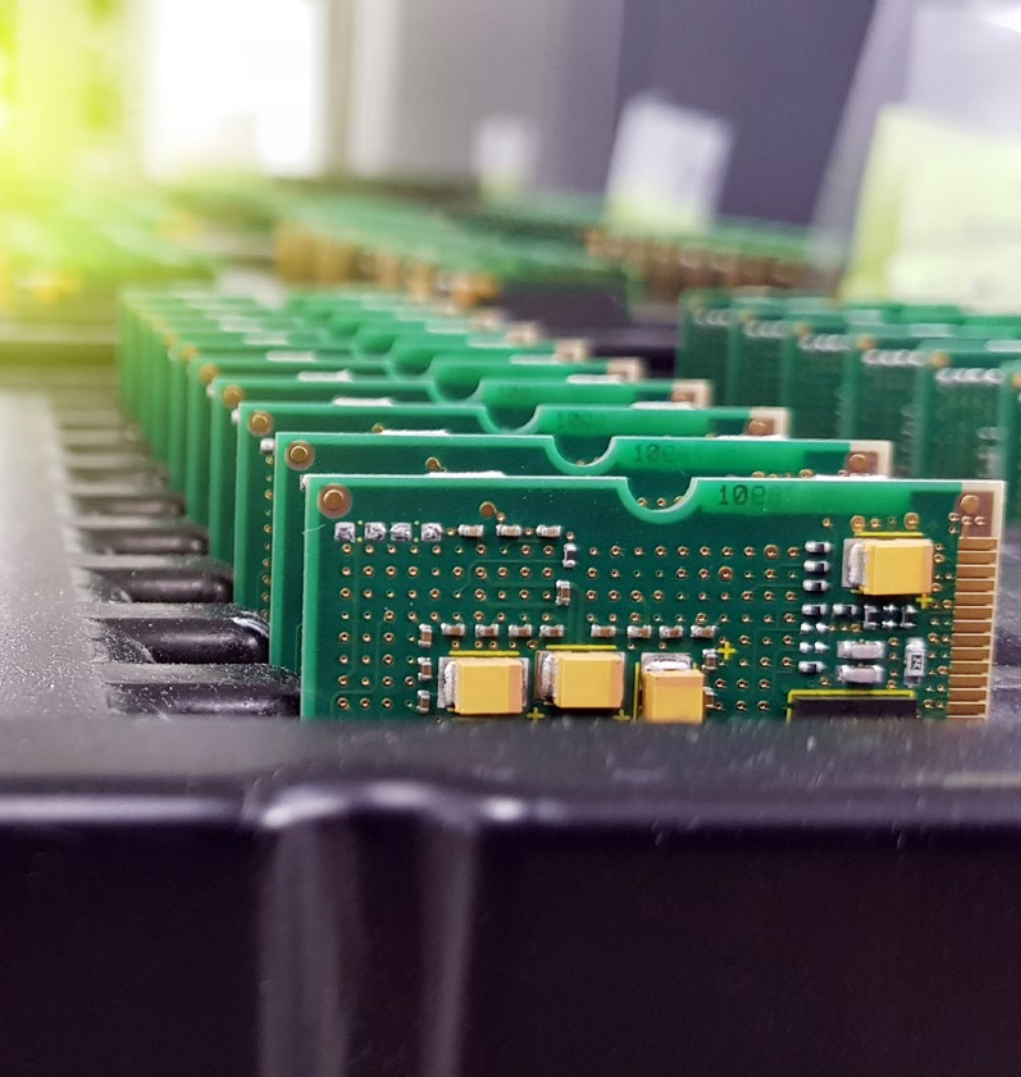


Atmer™ & Ionphase™



Migrating and
Permanent
Static Control
Additives



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 anti-static product range offers different technologies, physical forms and longevity to provide the required static control for different materials and applications.

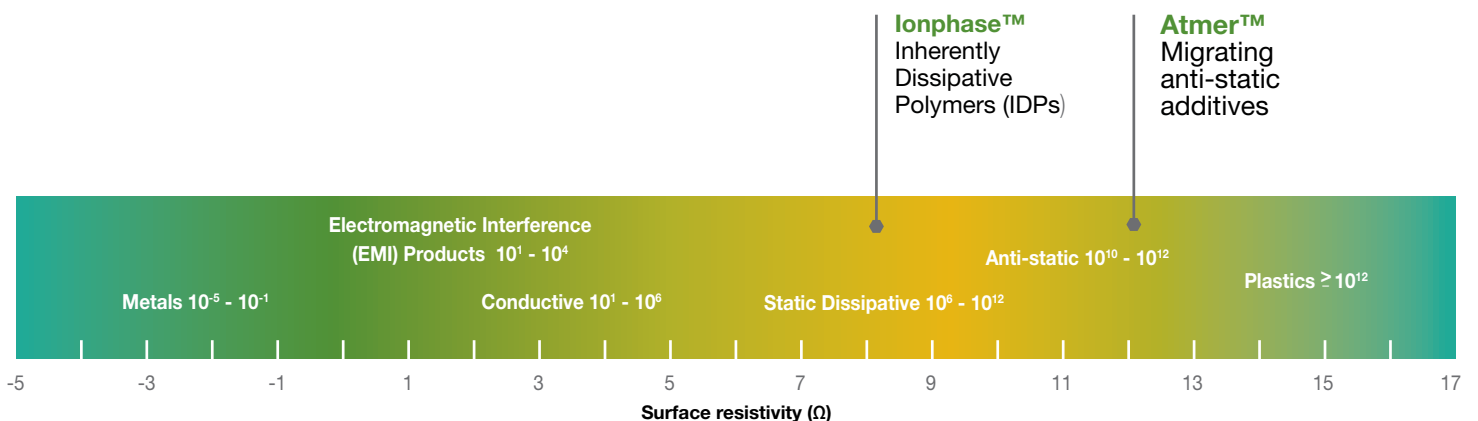
We can provide guidance on which products best suit your applications, polymer and industry.

What are Anti-static Additives?

Anti-static additives are added to plastics to reduce or eliminate static related issues. 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. Anti-static additives work by lowering the resistivity of a material so that charges are mobile and therefore will not cause static issues such as static 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 Anti-static 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:

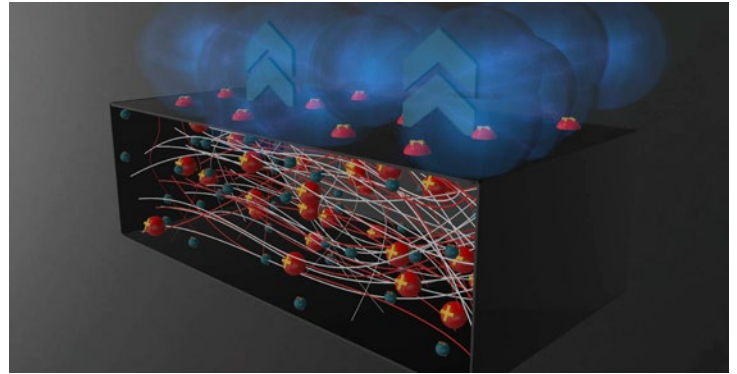
TYPE	WHAT ARE THEY?	HOW DO THEY WORK?	WHY CHOOSE THIS TYPE?
Permanent	Internally incorporated non-migrating static dissipative polymers	They reduce the resistivity of the blend by forming a co-continuous ion conductive phase within the host polymer	For permanent effect in automotive and packaging applications, or where applicable standards need to be met for example EX or EPA
Short & medium term	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
Externally coated	Externally applied anti-static additives	They are dissolved in an appropriate solvent and are then applied by spraying a wet coating onto the surface, or by dipping	When internal additives can't be used, where clarity is affected too much or no internal additive is available for example PET

Permanent Anti-static Additives

Our Ionphase™ range of Inherently Dissipative Polymers (IDP), also known as permanent anti-statics or ion conductive polymers, reduce the resistivity of the polymer providing control and safety for static related issues.

Key Benefits

- Immediate and permanent effect
- Humidity independent
- Uniform and homogenous distribution with no hot spots
- Minimal change to host polymer properties
- Good compatibility with host polymer
- Excellent processability and surface quality
- Suitable for compounding, extrusion or injection molding
- Meet requirements for key industry standards for EPA and EX areas



How Do Permanent Anti-static Additives Work?

Permanent anti-static additives, also known as non-migrating additives, are based on a high molecular weight polymer and do not move or migrate through or out of the plastic.

Permanent anti-statics are based on a co-continuous ion conductive polymer phase. Ions acting as charge carriers within the additive will dissipate the static field. This can be measured as lowered resistivity of the material.

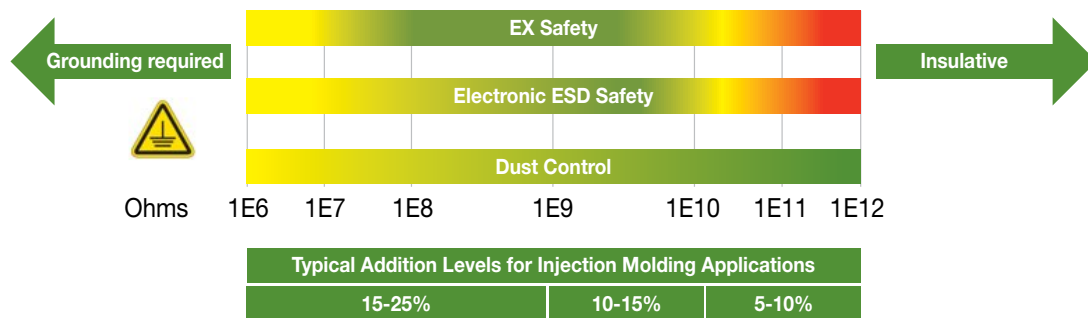
Choosing the Permanent Anti-static Additive for Your Application

In the static dissipative range of anti-static technology, the resistivity is related to the end application and safety requirements of the polymer.

Certain applications require specific surface resistivity such as:

- 1E8 Ω to 1E9 Ω when EX safety is a priority
- 1E9 Ω to 1E11 Ω for ESD protection
- 1E10 Ω to 1E12 Ω for optimum dust control

The level of resistivity that can be achieved using the Ionphase products 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

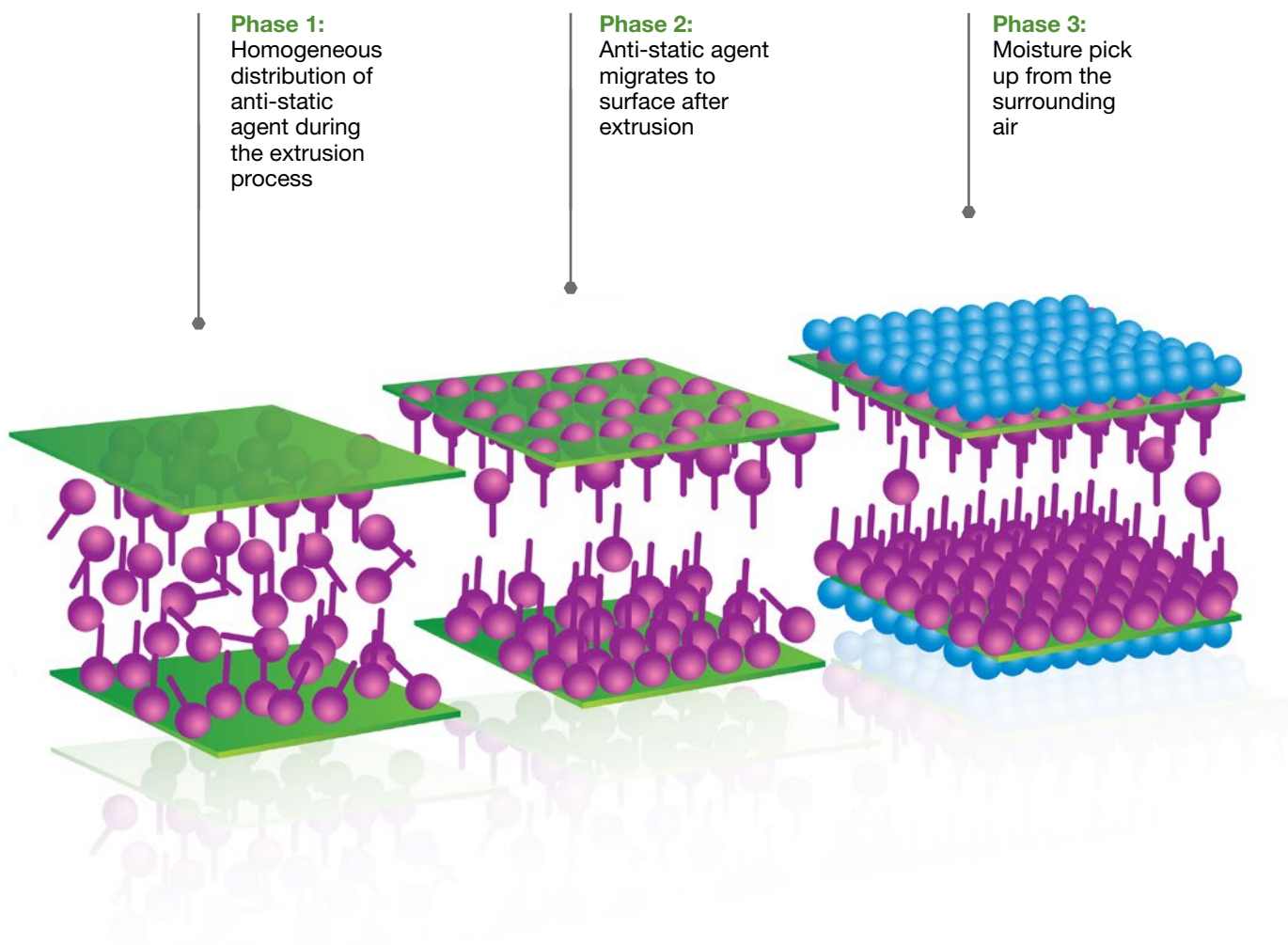
Short & Medium Term Anti-static Additives

Our Atmer™ range offers both internal and external migrating polymer additives that minimize electrostatic charge build-up. They can be used in a wide variety of polymers and applications and can be added to polymers as a masterbatch, during compounding or directly during extrusion, to reduce electrostatic attraction. Our additives are also available as highly loaded concentrates that are easier to dose and have a similar melting point.

How Do Migrating Anti-static Additives Work?

Short and medium term 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 anti-static additives



Product Listing

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



Permanent Anti-Static 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.

Short & Medium Term Anti-Static Additives

Applications

Cosmetics packaging, food packaging and automotive interior parts.

Host polymers

Polyolefins, PVC, styrenics.



Externally Coated Anti-Static Additives

Applications

When internal additives cannot be used, where clarity is affected too much or no internal additive is available.

Host polymers

PET



Permanent anti-static additives

YOUR POLYMER	PROCESSING		OUR RECOMMENDATION	PHYSICAL FORM T 25 °C	COMMENTS
	EXTRUSION	COMPOUNDING & INJECTION MOLDING			
Polyolefins	✓		lonphase™ PE0108M	Pellets	Suitable for blown film liners and other extrusion applications. Product has food contact compliancy according to EU 10/2011 regulation.
Polyolefins	✓		lonphase™ fSTAT series	Pellets	For use in general extrusion applications such as films, bags, liners and thermoformable sheets.
HDPE	✓		lonphase™ rSTAT series	Pellets	Designed for extrusion blow molding applications (IBC's, drums, canisters).
HDPE, PS, PA12		✓	lonphase™ U3	Pellets	Suitable for injection molding applications (ATEX, EPA, dust prevention).
ABS, PP	✓	✓	lonphase™ abSTAT	Pellets	Suitable for thermoformed trays used in electronics industry and for various injection molding applications (ATEX, EPA, dust prevention).
Styrenics (HIPS, GPPS)	✓		lonphase™ eSTAT2	Pellets	Suitable for thermoformed trays used in electronics industry.
Styrenics (PS, HIPS, ABS), POM	✓	✓	lonphase™ U2	Pellets	Recommended for thick POM sheets/profiles and various styrenics applications.
mPPO, PPS, PBT, PC		✓	lonphase™ hSTAT2	Pellets	Recommended for engineering plastics requiring high processing temperatures.
PC blends (PC/ASA, PC/ABS), PMMA, TPU, SEBS	✓	✓	lonphase™ U1	Pellets	Suitable for various injection molding and extrusion applications such as dust prevention in automotive interior parts and consumer appliances.
PMMA, PLA, PVC	✓	✓	lonphase™ trSTAT	Pellets	For use in transparent PMMA applications and for low processing temperature polymers.

Migrating Anti-static 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 anti-stat/lubrication balance is required.
	Atmer™ 125	Glycerol ester	Microbead	Vegetable	Suitable where short term anti-stat/lubrication balance is required. Only available for supply in Asia.
	Atmer™ 129 NV	Glycerol ester	Microbead	Non-vegetable	Suitable where short term anti-stat performance is required.
	Atmer™ 129	Glycerol ester	Microbead	Vegetable	Suitable where short term anti-stat performance is required.
	Atmer™ 1012	Glycerol ester	Pastille	Non-vegetable	Suitable where short term anti-stat/lubrication balance is required.
	Atmer™ 1013 NV	Glycerol ester	Pastille	Non-vegetable	Suitable where short term anti-stat performance is required.
	Atmer™ 1013	Glycerol ester	Pastille	Vegetable	Suitable where short term anti-stat performance is required.
	Atmer™ 154	Alkoxylated fatty acid ester	Liquid	Vegetable/synthetic	Suitable for use in flexible PVC only.
	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.
PET	Atmer™ 110	Ethoxylated sorbitan ester	Liquid	Vegetable/synthetic	Externally coated. Suitable for all polymers, but particularly effective in PET.
	Atmer™ 116	Ethoxylated sorbitan ester	Liquid	Vegetable/synthetic	Externally coated. Suitable for all polymers, but particularly effective in PET.
Concentrates					
Polyolefins	Atmer™ 7001	50% concentrate in polypropylene	Pellets	Vegetable	Fast acting, long-lasting anti-static effect
	Atmer™ 7002	50% concentrate in polypropylene	Pellets	Vegetable	Recommended for PP closures for antistatic and other mold release benefits.
	Atmer™ 7103	50% concentrate in polyethylene	Pellets	Vegetable	Mixture of additives to provide a synergistic anti-static effect
	Atmer™ 7105	50% concentrate in polyethylene	Pellets	Vegetable	Fast acting, long-lasting anti-static effect
	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 polypropylene	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:

Smartmaterials@cargill.com

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