pcc CHEMAX

We don't simply sell products...*we sell solutions.*™

Distributed by

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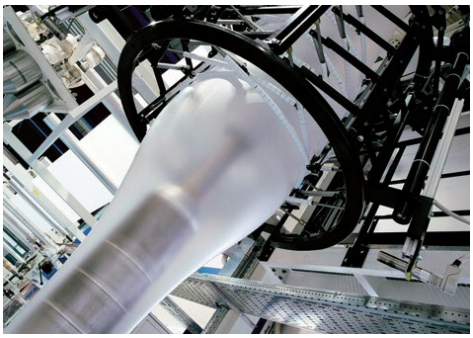
Polymer Additives - REACH



Antistats

Slip Agents

Antifogs

Corrosion Inhibitors

Pigment Dispersants

POLYMER ADDITIVES

PCC Chemax, Inc. has conducted pre-registration of the substances / monomers which make up the products marked in support of our sales into the European Union (EU) market. The pre-registrations do not take into account sales to domestic customers or non-EU markets.

COMPANY OVERVIEW

PCC Chemax was founded in 1973 to develop specialty surfactant additives for specific markets and individual customer needs. We specialize in servicing the industrial compounders in Metalworking, Metal Finishing, Plastics, and Oil Field Industries. Our products are used as processing aids, property enhancers, and chemical additives in the manufacture of a wide variety of industrial products. As a service oriented company, we focus on product development and cooperative research with our customers. The research, product development, and laboratory personnel of our customers become our partners in the development of unique surfactant additives to meet their specific and specialized needs.

CAPABILITIES

PCC Chemax's Polymer Additives group offers technical support in addressing additive solution challenges customers present. In addition to introducing new materials like antistats, antifogs, lubricants, pigment dispersants, and slip agents, the polymer staff is well versed in a variety of polymers including PET, PE, PU, LLDPE, LDPE, HDPE, and PP.

With hundreds of chemistries available, the technical department can explore non-traditional molecular structures and substantiate results with standard industry testing methods. They address traditional industry issues as well as the most recent challenges that include long term antistatic protection and corrosion inhibition.

Piedmont, SC

Duisburg, Germany

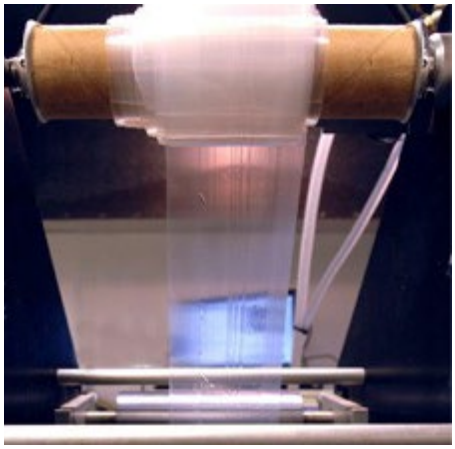
Located in Piedmont, SC, our research labs are comprised of synthesis and application capabilities for each industry we serve.

In 2006, Chemax was acquired by PCC SE, headquartered in Duisburg, Germany. The acquisition connected our company with PCC Rokita, in Brzeg Dolny, Poland, whose alkoxylation capabilities enhance our global synergies to supply our customers around the world.

This brochure is offered as a starting point. It presents some of the more standard commercial products, many of which are currently maintained in inventory. Additions to the product line and potential variations of listed products make the information presented only representative. We invite your inquiries for specific requirements of related homologues. Please see our website for the most complete list of products and corresponding information.

Antistats are added to the polymer compound or may be applied externally to the surface. If added internally, it must migrate (bloom) to the surface in order to absorb moisture from the air and ionize to make a conductive path for charges to bleed-off (dissipate). Their mechanism consists of a hydrophobic end, which ensures that the antistat is attached to the polymer surface and a polar end that absorbs the water molecules.

Choosing the Right Antistat for Optimal Performance



- FDA status or requirement – clearance as a food contact substance (for packaging).
- Is an **internal** or **external** antistat required? Internal antistats are compounded into the polymer matrix and external antistat are applied on the surface from aqueous or alcohol solutions.
- Process temperature and relative humidity conditions of the process.
- Application is important in how the antistat will affect the appearance of the end-use product.
- Solubility and use level of the antistat in the polymer.
- Molecular structure and molecular weight of the antistat. In general, the higher the molecular weight of an antistat, the higher the thermal stability.
- Degree of orientation (stretch ratio) of the polymer matrix.

Typical Use Level of Antistats for Optimal Performance

Polymer	Antistat (Internal)	Use Level %
HDPE, LDPE, LLDPE	Ethoxylated Amines Lauric Diethanolamide	0.10 — 0.40 0.15 — 1.2
Polypropylene	Ethoxylated Amines Lauric Diethanolamide Glycerol Monostearate	0.15 — 80.0 0.25 — 0.2 0.05 — 0.60
Rigid PVC	Quaternary Compounds Sodium Alkyl Sulfonate	0.8 — 1.3 1.0 — 1.5
PET	Sodium Alkyl Sulfonates	1.0 — 2.0
Polycarbonate	Sodium Alkyl Sulfonates	1.5 — 2.5
Styrenics	Ethoxylated Amines Lauric Diethanolamide Quaternary Compounds	1.0 — 4.0 1.5 — 2.5 0.10 — 3.0

Measuring Effectiveness

The following tests are conducted to characterize antistat effectiveness:

1) **Static Decay Time** measures the static discharge rate. The quantity to be measured is the time (in seconds) in which the applied charge (5kV) has dropped according to a specific percent cutoff level.

2) **Surface Resistivity** Characterization of conductivity by measuring the surface resistance. As the charge in the plastic decreases the surface resistivity drops.

Two of the specifications that are desired in the plastics industry are:

1) **NFPA (National Fire Protection Association) 99 Specification Health Care** In order to meet this specification, the material must meet static decay time of 0.5 seconds or less at 50 ± 2% relative humidity at a temperature of 23 ± 1°C

2) **MIL-B-81705C- Military Specification (Federal Test Method Std No. 101C Method 4046.1)** In order to meet this specification, the material must meet 2.0 seconds static decay or less at 12 ± 3% relative humidity at a temperature of 73 ± 5°F and surface resistivity of 10^{12} or less according to **ASTM D 257** (industry standard for testing surface resistivity).

The humidity and storage time of the testing specimen is of great importance for the information of the antistat effect. The humidity and storage time also needs to be taken into consideration when testing according to MIL-B-81750C (Military Specification) and NFPA 99 (Health Care) specifications.

Correlation Between Surface Resistance and Static Decay in Plastics

Antistat Efficiency In Polymers	Surface Resistivity ASTM D257 (In Ohms)	Static Decay Time In Seconds
Excellent	10^9	0
Very Good	10^9 to 10^{10}	1
Good	10^{10} to 10^{11}	2 to 10
Moderate	10^{11} to 10^{12} 1	0 to 60
Poor	10^{13}	>60

Products by Application

Product	Form	Polymer(s)	FDA Approved	REACH* Pre-registered
Chemstat® 106/G90	Liquid	PS, PET, PVC, Acrylics		■
Chemstat® 122	Liquid	PP,PE, PS/ABS	■	■
Chemstat® 122/60DC	Powder	PP, PE, PS/ABS	■	■
Chemstat® 182	Liquid	PE(HDPE, LDPE, LLDPE), PP	■	■
Chemstat® 182/67DC	Powder	PE	■	■
Chemstat® 192/NCP	Powder	PE, PS/ABS	■	■
Chemstat® 273-E	Solid	PP, PE, ABS	■	■
Chemstat® 1810	Liquid	PP, PE	■	■
Chemstat® 1860	Liquid	PE, PP	■	■
Chemstat® 1870	Liquid	PE, PP	■	■
Chemstat® 1880	Flakes	PE, PP, PVC	■	■
Chemstat® 1882	Solid	PE, PP	■	■
Chemstat® 1890	Liquid	PE, PP	■	■
Chemstat® 1900	Liquid	PET, PE, PP, PVC	■	■
Chemstat® 1910	Solid	PET	■	■
Chemstat® 3820	Liquid	PP, PVC, ABS, PVC, Nylon		■
Chemstat® 6000/50 DC	Powder	PP	■	■
Chemstat® AS-CPU2	Solid	PE, PS, PU, ABS, PET, PVC, HIPS	■	■
Chemstat® G-118/42	Flakes	PE, ABS, PU, PS, HIPS, Nylon	■	■
Chemstat® G-118/52	Flakes	PE, ABS, PU, PS, HIPS, Nylon, PVC	■	■
Chemstat® LD-100	Solid	PP, PE(HDPE, LDPE, LLDPE), PU	■	■
Chemstat® LD-100/60DC	Powder	PP, PE(HDPE, LDPE, LLDPE), PU	■	■
Chemstat® P-400	Liquid	PS/ABS, PE	■	■
Chemstat® PS-101	Pellet/Solid	PP,PET, PVC, PS/ABS, PC, PE	■	■
Chemstat® PS-118	Liquid	PP		■
Maxomer® AS-185	Liquid	PE(HDPE, LDPE, LLDPE)		■
Maxomer® AS-1018/75DC	Powder	PE(HDPE, LDPE, LLDPE)	■	■

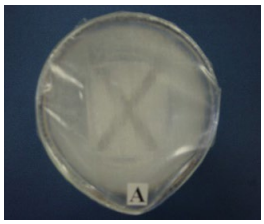
How do Antifogs Work?

Antifogs prevent the formation of water droplets on the surface of a film. This is achieved by incorporating an additive designed to have controlled incompatibility with the polymer matrix and chemical functionality that allows it to sheet the water droplets. The best antifog for a specific application will depend on polymer type, film thickness, use temperature, and lifetime of the film. FDA requirements should be identified prior to evaluation.

How are Antifogs Tested?

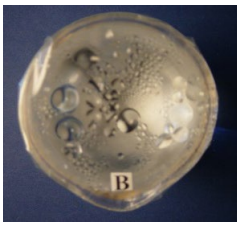
All films are run using a Brabender Intelli-Torque 19mm 25:1 extruder outfitted with a mixing screw and 4 or 6 inch adjustable slit die set to a 0.015 inch gap. Films are cast onto 25°C chill rollers with minimal (<10%) draw.

Antifogs are evaluated for performance under conditions of heat and cold. In both tests, a beaker is partially filled with water and a film is stretched over the beaker. For the cold fog evaluation, the beaker is kept at 4°C. For hot fog evaluation the beaker is placed in a 60°C water bath. In each case, the films are evaluated over time relative to the age of the film and exposure time to the conditions. Performance is ranked based on the scale below:



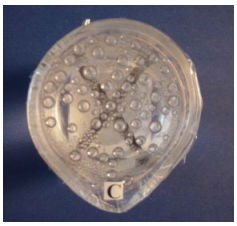
Very Poor

Opaque layer of small fog droplets



Poor Performance

An opaque or transparent layer of large droplets

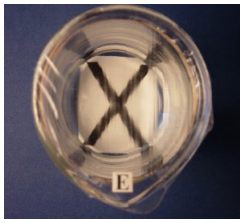


Poor Performance

A complete layer of large transparent drops

Acceptable

Some drops randomly scattered



Excellent

A transparent film displaying no visible water

Products by Application

Product	Form	Polymer(s)	FDA Approved	REACH Pre-registered
Chemstat® 1880	Flakes	PE,PP	■	■
Chemstat® 1900	Liquid	PET, LLDPE	■	■
Chemstat® AF-322	Liquid	PP, PE/EVA	■	■
Chemstat® AF-687	Liquid	PP, PS, PE	■	■
Chemstat® AF-730	Liquid	PE, PP, PS, PVC, PE/EVA	■	■
Chemstat® AF-1820	Solid	PE, LDPE, PP, PE/EVA	■	■
Chemstat® AF-1879	Paste	PS	■	■

How do lubricants function?

Lubricants are used as processing aids particularly in rigid and flexible PVC. They can either be incorporated into the polymer compound or applied externally to the polymer surface. A lubricant works by providing a considerable decrease in resistance to movement of chains or segments of a polymer, without disproportionate change in observable properties. Ease of internal rotation is the key to polymer flow.

Internal lubricants reduce friction between polymer molecules, leading to lower melt viscosity and low energy input needed for processing. Internal lubricants are usually chemically compatible with the polymer. External lubricants are generally incompatible with the polymer and act to reduce friction at the interface of the polymer and the surface of the processing equipment.

Choosing the right lubricant for optimal performance

Choosing the correct lubricant to obtain trouble-free processing is a well-defined art. Lubricant choice for new applications requires careful experimentation. The chemical composition, polarity, melt properties, compatibility, and interactions with other additives all must be considered in designing the optimum formulation; i.e., ethylene bi-stearamide acts as both an internal and external lubricant. It promotes flow and metal release in PVC; however, it cannot be used in clear film application – it will haze the film. In clear film application, glycerol monostearate is used.

Available for:

- Nylon
- PVC
- Polyethylene
- Polypropylene
- Polycarbonate
- PU (Polyurethanes)
- SAN (Styrene acrylonitrile)
- Styrenics

Products by Application

Product	Form	Polymer(s)	FDA Approved	REACH Pre-registered
Chemstat ® G-118/42	Bead	PP,PE,PS, Nylon, SAN, PU	■	■
Chemstat ® G-118/52	Flake	PP, PE,PS, Nylon, SAN,PU	■	■
Chemstat® G-118/9501	Powder	SAN, PU	■	■
Chemstat® G-118/GTS	Powder	PP,PE,PS	■	■

Melt point & internal/external application

Product	Melt Point °C	Application
Chemstat® G-118/42	61	Internal
Chemstat® G-118/52	61-63	Internal
Chemstat® G-118/GTS	65-73	Internal/External

How do Slip Agents Function?

PCC Chemax slip agents provide surface lubrication during and immediately after processing. Slip agents function by exuding to the surface of the plastic and provide a coating which lowers the coefficient of friction. In addition, they reduce the ability of a plastic sheet or film to adhere to itself by minimizing tack. PCC Chemax slip agents have anti-block properties; they also play a role during processing in preventing the polymer from adhering to metal. The reduced friction facilitates processing on high speed packaging equipment as well as easing consumer use of plastic film products.

Measuring the Effectiveness of a Slip Agent

Slip properties are tested by ASTM Test Method D 1894. This test is the coefficient of friction test that measures the ratio of the force required to move one film surface over another to the total force pressing the two surfaces together. Thermoplastics with a ratio greater than 0.8 show no slip properties and a ratio of less than 0.2 define high slip properties.

Factors to Consider When Choosing a Slip Agent

- FDA status
- Process temperature
- Melt Point (i.e., amides with higher melting point provide better slip properties)
- Bloom rate (i.e., oleamide blooms faster than erucamide)
- Impact on taste and odor

Available for:

- Polyethylene
- Polypropylene
- Polyvinyl chloride
- Nylon
- Polycarbonate

Products by Application

Product	Form	Polymer(s)	FDA Approved	
Chemstat® HTSA #1A	Bead	PP	■	■
Chemstat® HTSA #18	Bead	PP,PE	■	
Chemstat® HTSA #18-20M	Bead	PP, PE	■	■
Chemstat® HTSA #22	Bead	PP,PE	■	■
Chemstat® HTSA #22-20M	Bead	PE	■	■
Chemstat® HTSA #3/BEAD	Bead	PVC	■	■
Chemstat® HTSA #54	Bead	PVC, PC	■	■

Melt point & Internal/External Application

Product	Melt Point °C	Application
Chemstat® HTSA #1A	63 - 80	Internal
Chemstat® HTSA #18	70-76	Internal
Chemstat® HTSA #18-20M	68-78	Internal
Chemstat® HTSA #22	78-85	Internal
Chemstat® HTSA #22-20M	78 - 88	Internal
Chemstat® HTSA #3/BEAD	70 – 76	Internal
Chemstat® HTSA #54	63	Internal

How do Pigment Dispersants Function?

Pigment dispersants are used in high content dispersions of colorants in carrier resins or liquid systems. The dispersion of a pigment is a process by which the pigment particles are "wetted" down by the resin in the liquid or molten stage. How well the pigment disperses depends on the temperature at which the two materials are mixed, the particle size of the pigment, and the molecular weight of the polymer. The mixing time and equipment are very important. Dispersion is the key to successful coloring.

Advantages When using a Pigment Dispersant

- Higher loading of pigment in masterbatch
- Faster and more reproducible production
- Control of color development
- Prevention of flocculation

PCC Chemax offers a line of pigment dispersants to aid in high loadings of pigment into color concentrates and liquid systems.

For color concentrates

Product	Thermal Stability, °C	Application
Maxsperse® 8913/PWDR	290	Free-flowing powdered form of Maxsperse® 8913/PWDR

For liquid color systems

Product	Thermal Stability, °C	Application
Maxsperse® 9500	270	Good dispersant in liquid color systems. FDA Clearance
Maxsperse® 9550	280	Similar properties to Maxsperse® 9500; however, FDA clearance
Maxsperse® 9700	290	FDA clearance
Maxsperse® 9800	350	Excellent dispersant in liquid color systems and good thermal stability. FDA clearance
Maxsperse® 9800/LM	280	Low moisture version of Maxsperse® 9800 (0.75% water) FDA clearance

Products by Application

Product	Form	Polymers	FDA Approved	REACH Pre-registered
Maxsperse® 8900/100M	Powder	PP, PS	■	■
Maxsperse® 8913/PWDR	Powder	PP,PE, PS, SBR	■	■
Maxsperse® 9200DO	Liquid	PP, PE	■	■
Maxsperse® 9500	Liquid	PP,PE	■	■
Maxsperse® 9550	Liquid	PP, PE	■	■
Maxsperse® 9700	Liquid	PP, PE	■	■
Maxsperse® 9800	Liquid	PP, PE	■	■
Maxsperse® 9800LM	Liquid	PP, PE	■	■
Maxsperse® W-85	Powder	PP, PE	■	■
Maxsperse® W-3000	Powder	PP, PE	■	■
Maxsperse® W-6000	Bead	PP, PE	■	■

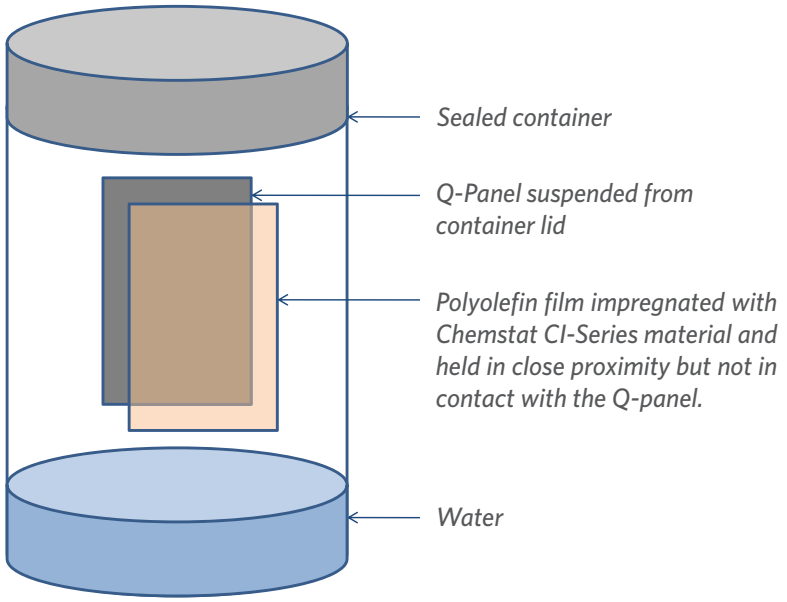
How do Corrosion Inhibitors Function?

Corrosion Inhibitors can be used as additives in packaging films and containers to minimize corrosion on metal parts including ferrous, steel, copper and galvanized materials. The CI is incorporated into the polymer during processing and migrates to the surface before volatilizing in the airspace between the metal and the polymer.

Choosing the Right Corrosion Inhibitor for Optimal Performance

Inhibitors are chosen based on the metal substrate to be protected. Factors regarding time frame for protection and polymer specifications must also be considered.

The Q-panel/film sample is suspended from the lid of the sealed container and aged for 24 hours at room temperature. 50ml of water is introduced to the container and the system held at room temperature for 2 hours. The system is then heated for 2 hours at 45° C. The samples are removed, dried, and examined for corrosion.



Chemstat® CI products are suited for protection of metal parts during shipping and storage.

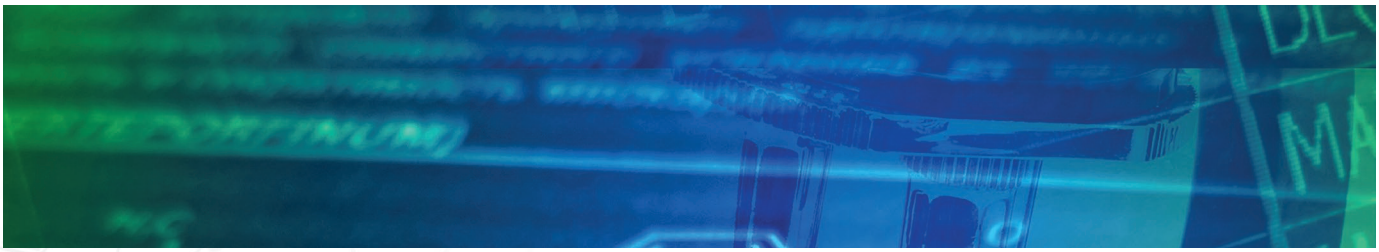
Products by Application

Product	Form (25 C)	Polymers	FDA Approved	REACH Preregistered
Chemstat ® CI-1020	Liquid	PP, PE, HDPE, LLDPE	■	■
Chemstat ® CI-1020/60DC	Powder	PP, PE, HDPE, LLDPE	■	■

Please see our website's Products tab for the most complete list of products and corresponding information.

PCC Chemax, Inc. offers specialty chemicals for the Metalworking, Metal Plating, Metal Cleaning, Polymer Additives, and Oilfield Industries. Industry specific guides outlining our products' chemistries are available upon request. More detailed information regarding specific product data or MSDS can be found via our website under the Literature tab.

Contact our Piedmont, SC office us with other questions or sample requests.



PCC CHEMAX

We don't simply sell products...*we sell solutions.*™

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