Honeywell
THE POWER OF CONNECTED

Performance Additives

Printing Inks

Honeywell Gives You Every Advantage

Honeywell A-C®
Performance Additives

Honeywell's A-C® Performance Additives help you improve a multitude of processes and products. They help make your printing inks perform better, manufacture more easily, and maintain cost-effectiveness. They give you a competitive edge in the marketplace that lets you increase profitability. With a versatile line of nearly 100 polyethylene, copolymer, and micronized polyolefin waxes, we can offer a diverse array of chemistries, properties, and particle sizes that meet virtually any ink requirements you have.

You Have a Wide Range of Choices

The versatile line of A-C® Performance Additives includes a variety of different chemical functionalities that can satisfy the needs of a multitude of printing ink applications. Among our offerings are low molecular weight polyethylene homopolymers, oxidized polyethylene polymers, polyethylene copolymers, polypropylene polymers, and the ACumist® series of micronized polyolefins. Many of the polymers also have post-reacted versions.

You Can Rely on Honeywell's Expertise

Honeywell has more than 50 years of experience in the field of polymer science. We were the first to produce polyethylene waxes. Years of innovation in product design and experience in solving problems for our customers have made our line of A-C polyethylenes the world's broadest, most versatile family of low molecular weight polyethylene waxes.

Today, we are still one of the world's leading manufacturers of low molecular weight polyethylene polymers and copolymers and have the know-how and expertise to consistently deliver products of the highest quality.

But products of the highest quality are only one part of the Honeywell equation. You also get the advantage of our global supply and customer service capabilities, assuring you of the right product delivered when and where you need it. And you get the benefits of our vast industry applications knowledge and formulations know-how that can help you formulate your products easily and cost-effectively.

Here's How You Can Use A-C Performance Additives

A-C polyethylenes, A-C copolymers, and ACumist micronized polyolefins are a family of synthetic waxes used as additives or modifiers in printing inks to improve mar and abrasion resistance, slip, control of rheology, and other properties.

In ink applications, a fluid is spread in a thin layer on a substrate. The layer hardens into an adherent film through the action of any of a number of mechanisms. You can use polyethylene waxes to modify the properties of both the applied fluid and the final film. In the fluid, the polyethylene wax can control its rheology characteristics. In the final film, the low molecular weight polyethylene wax can modify surface properties, such as coefficient of friction, mar and abrasion resistance, and gloss. These property enhancements are important to ink manufacturers.

Structure and Properties

As the charts to the right of the page show, the properties of low molecular weight polyethylene waxes can be described on three levels: by their molecular (structural) features, by their physical properties, or by their application properties.

Molecular Features

Because of the heterogeneous nature of their molecular weight and composition, it is virtually impossible to completely determine the molecular structure of polyethylene waxes. As with any other polymer, it is necessary to describe these materials by averages and distributions. The molecular weight of these products range from 700 to 5,000, making them compatible with many ingredients used in the manufacture of printing inks.

It is important to remember, too, that no single structural characteristic determines a physical property. Rather, most physical properties stem from a combination of the structural characteris tics. Melt viscosity, for instance, is the result of a combination of all of the structural characteristics of a material.

Many qualitative relationships between structural characteristics and physical properties are well recognized. Higher molecular weights, for example, lead to higher viscosities. Usually, though, it is difficult to develop detailed quantitative relationships.

Physical Properties

Wax grades are most frequently described and distinguished by their physical properties. On a theoretical level, it would be easy to list as many as 100 wax properties that could be of value in ink applications. On a more practical level, however, that list can be limited to a lower number of the most important properties, as shown in the chart.

Application Properties

It is the application properties, however, that are of direct concern to the ink maker. These properties stem, not just from the physical properties of the wax, but from a complex interaction between the wax and the other ingredients, and from the processing methods. That's where Honeywell's vast experience comes into play. Because of their expertise and experience, our technical service personnel, who are knowledge-able in more than 20 end uses that utilize our polyethylene waxes, can help you quickly zero in on the wax best suited for your application. There are times, however, when the best wax for a particular application can only be determined empirically.

The applications properties listed here summarize the key character-istics of low molecular weight polyethylene waxes in inks. Among the most important characteristics are slip and anti-blocking properties, trapping, as well as mar and abrasion resistance.

Molecular (Structural) Features

Composition (co-monomer)
Composition Distribution
Molecular Weight
Molecular Weight Distribution
Degree of Branching

Physical Properties

Density
Crystallinity
Hardness
Softening Point
Toughness
Melt Viscosity
Hydrophobicity
Solubility
Emulsifiability

Application Properties

Abrasion Resistance
Mar Resistance
Slip
Rheology
Gloss Control
Trapping
Anti-block
Anti-offset

ACumist® Micronized Polyolefin Waxes

INKS AND OVERPRINT VARNISHES	BENEFIT	GRADE
Gravure/Flexographic Water Based Ink	Rub Resistance Coefficient of Friction Reduction Blocking Resistance	A-5, A-6, A-12, A-18
Gravure/Flexographic Solvent Based Ink	Rub Resistance Coefficient of Friction Reduction Blocking Resistance Trapping	A-5, A-6, A-12, B-6, B-9, B-12, B-18 C-5, C-12 3105B, 3205B
Lithographic	Rub Resistance Coefficient of Friction Reduction Blocking Resistance	B-6, B-9, C-5, D-9 3105B, 3205B
Overprint Varnish	Coefficient of Friction Reduction Blocking Resistance Mar & Abrasion Resistance	A-12, A-18 3105B, 3205B
SPECIALTY INKS - DIGITAL, UV/EB		
Hot Melt	Viscosity, Flow Modifier Mar & Abrasion Resistance	A-12, B-12
Liquid	Viscosity, Flow Modifier Mar & Abrasion Resistance	A-5, A-6, A-12
UV/EB	Scratch Resistance Coefficient of Friction Reduction	A-5, A-6, B-6, C-5 3105B, 3205B

A-C® Polyethylenes and Copolymers

INK TYPE	BENEFIT	GRADE	
Heatset	Rub Resistance Coefficient of Friction Reduction Blocking Resistance	A-C 6, A-C 1702 A-C 8, A-C 617	Compound
Sheetfed	Rub Resistance Coefficient of Friction Reduction Blocking Resistance	A-C 6, A-C 1702	Compound
Liquid Solvent Inks	Rub Resistance Coefficient of Friction Reduction Blocking Resistance	A-C 9A, A-C 8A, A-C 6A, A-C 810A, A-C 820A	Media Milling
Overprint Varnish Liquid Water Based Inks	Coefficient of Friction Reduction Blocking Resistance Mar & Abrasion Resistance	A-C 316, A-C 325, A-C 330, A-C 392	Emulsion
SPECIALTY INKS			
Hot Melt	Viscosity, Flow Modifier, Adhesion Mar & Abrasion Resistance	A-C 5120, A-C 617	Dispersion
Digital, UV/EB	Scratch Resistance Coefficient of Friction Reduction	A-C 617, A-C 1702	Dispersion

Dispersion Techniques

Polyethylene waxes must be finely dispersed for incorporation into inks. Fine dispersions can be produced by one of four methods: media milling, shock cooling, emulsification, or micronization.

The method chosen depends on your required particle size, the formulation, and the equipment available. A range of particle size variations is possible, depending on the reduction procedure used.

Procedure	Typical Particle Size
Media Milling	12 Microns
Shock Cooling	2 Microns
Emulsification	0.07 Microns
Micronization	3-18 microns

Media Milling

In this method, an A-C® polyethylene wax concentrate is prepared by ball or pebble milling into a solvent or resin solution. Most common solvents, from aliphatics to alcohols, work well. If a resin is included during the grinding process, the milling time may need to be lengthened because of increased viscosity. However, the resin will enhance the stability of the dispersion.

Shock Cooling

In the shock cooling method, a mixture of solvent and A-C polyethylene is heated to a temperature high enough to dissolve the wax, then the hot solution is cooled, sometimes by adding cold solvent. The particle size and rheological characteristics of the resultant gel will vary with the procedure chosen, such as changing the rate of cooling and/or agitation. This method yields an extremely fine, uniform particle size dispersion.

Emulsification

This procedure is used to prepare submicron particle size aqueous emulsions of carboxylic acid functional A-C polyethylenes. In this method, melted A-C polyethylene wax is blended with surfactant and acid groups are neutralized with a base while stirring rapidly into water. The A-C polyethylene grade and the equipment available determine the exact parameters of the procedure. The end use application determines the type and level of surfactant needed. Surfactants can be anionic, nonionic, or cationic.

Micronization

Honeywell provides a number of micronized waxes. These products can simply be stirred into many formulations with low shear mixing. You may find that preparing a pre-dispersion will facilitate the addition of the ACumist® products into your ink.

Performance Benefits

Mar and Abrasion Resistance

Abrasion is an all-encompassing term that covers marring, scuffing, rub-off, scratching, and other damage to a film surface caused by an object rubbing against or sliding over it.

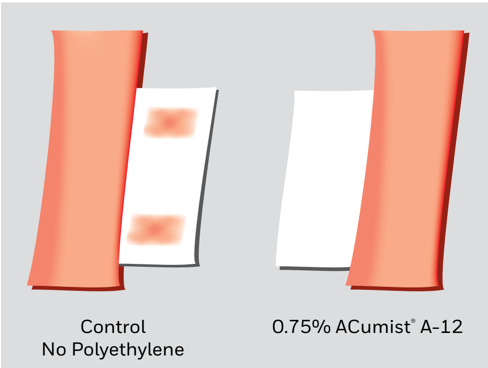
In general, the abrasion resistance of a film is determined primarily by the toughness and degree of cross-linking of the resin system. Once you select a resin system for your application, adding a small amount of an A-C® polyethylene wax to the formulation can be a cost-effective method for increasing the abrasion resistance, without affecting other important properties.

In most systems, wax particles protrude above the film surface. An abrading surface rides on these particles, reducing its contact with the film and, consequently, reducing abrasion damage. Obviously, slip and abrasion resistance are related in that the slip control contributed by the wax also provides some resistance to abrasion. Surprisingly, however, the wax that gives the lowest coefficient of friction to the film does not necessarily provide the greatest abrasion resistance.

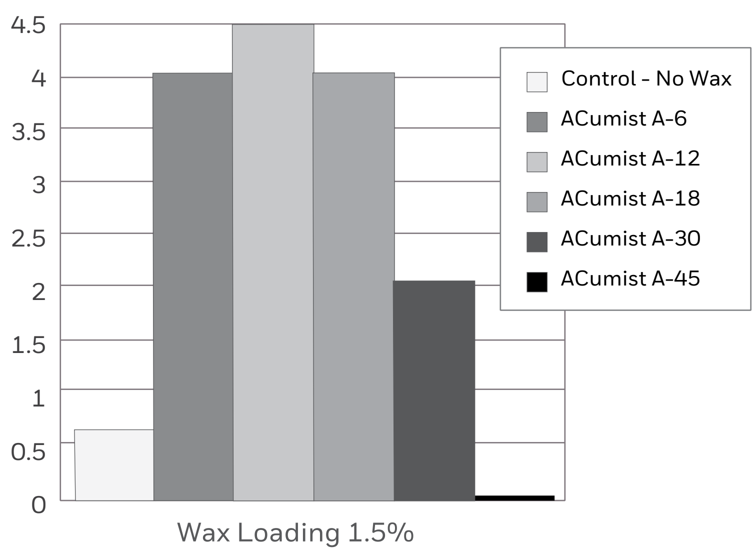
Several properties of a wax, especially hardness and particle size, contribute to its effectiveness in increasing abrasion resistance. Harder polyethylenes usually perform better than softer ones. Larger wax particles are generally more efficient than smaller ones but have a tendency to reduce gloss.

Sutherland Rub Resistance Test

(25 cycles with 4 lb. weight)



Micronized Particle Size vs. Rub Resistance In Water Based Flexographic Inks



0= Significant Surface Damage
5= No Surface Damage

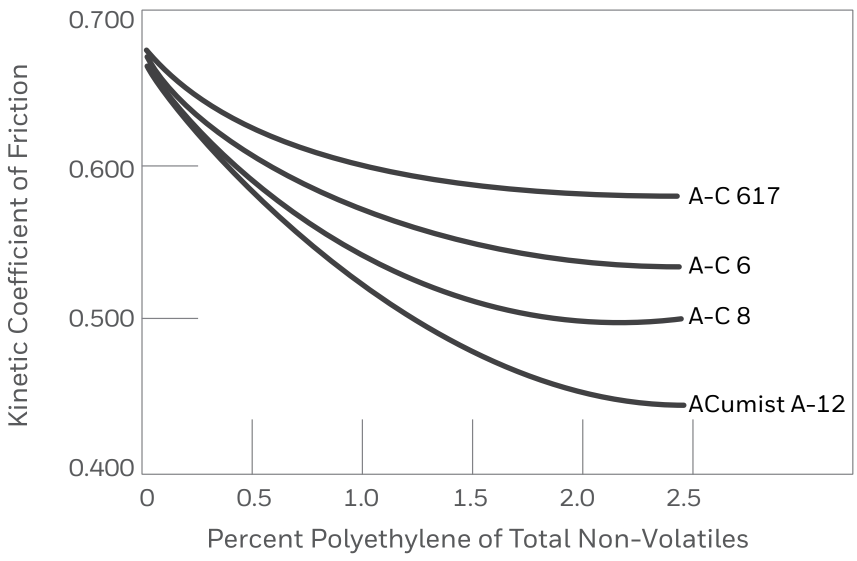
Slip and Anti-Block

Slip, a measure of the coefficient of friction (COF), is an important property in many ink applications. Unlike properties like abrasion resistance where "more" is almost always better, slip is usually optimal within an upper and lower limit. Proper slip is important to the trouble-free run of paper through the presses and in subsequent operations. For example, a coated paper that is too slippery may not stack properly, yet it must have sufficient slip to move easily along a production line.

Dispersed polyethylene at the surface of an ink is responsible for improved slip, either because the solid polyethylene wax particles act as ball bearings, or because local frictional heating creates a layer of molten wax. Experimental evidence indicates that transfer lubrication, in which a small amount of wax is transferred from the coating to the sliding surface, is also a factor.

The most effective polyethylene wax for any given situation is not always obvious. Sometimes, a combination of hard and soft polyethylenes will give you the greatest modification in COF.

A-C polyethylenes decrease the coefficient of friction of a typical ink



Trapping

A-C® polyethylenes are particularly effective when a second or third color is overprinted on an existing color (trapping). A-C polyethylenes provide the required slip and mar resistance, without interfering with the adhesion of the next color.

Other Ink Advantages

A-C polyethylene and ACumist® additives also contribute to improved rheology characteristics, squalene resistance, and may reduce misting and tack.

The Competitive Edge

A-C® Performance Additives offer many important advantages and properties that can be utilized effectively in a wide variety of ink formulations. The characteristics they provide let you make more efficient, cost-effective products that keep your customers satisfied.

Learn how to put the power of A-C Performance Additives to work for you. Visit our web site: **www.honeywell.com/additives** for more detailed information or to request a product sample.

For additional information or to contacts us, please visit
honeywell-additives.com

All statements and information provided herein are believed to be accurate and reliable, but are presented without guarantee, warranty or responsibility of any kind, express or implied. Statements or suggestions concerning possible use of our products are made without representation or warranty that any such use is free of patent infringement, and are not recommendations to infringe any patent. The user should not assume that all safety measures are indicated herein, or that other measures may not be required. User assumes all liability for use of the information and results obtained.

Responsible Care®
Our commitment to sustainability

A-C, ACumist and AClyn are registered trademarks of Honeywell International Inc.

1767 PA | November 2017
© 2017 Honeywell International Inc. All rights reserved.

Honeywell