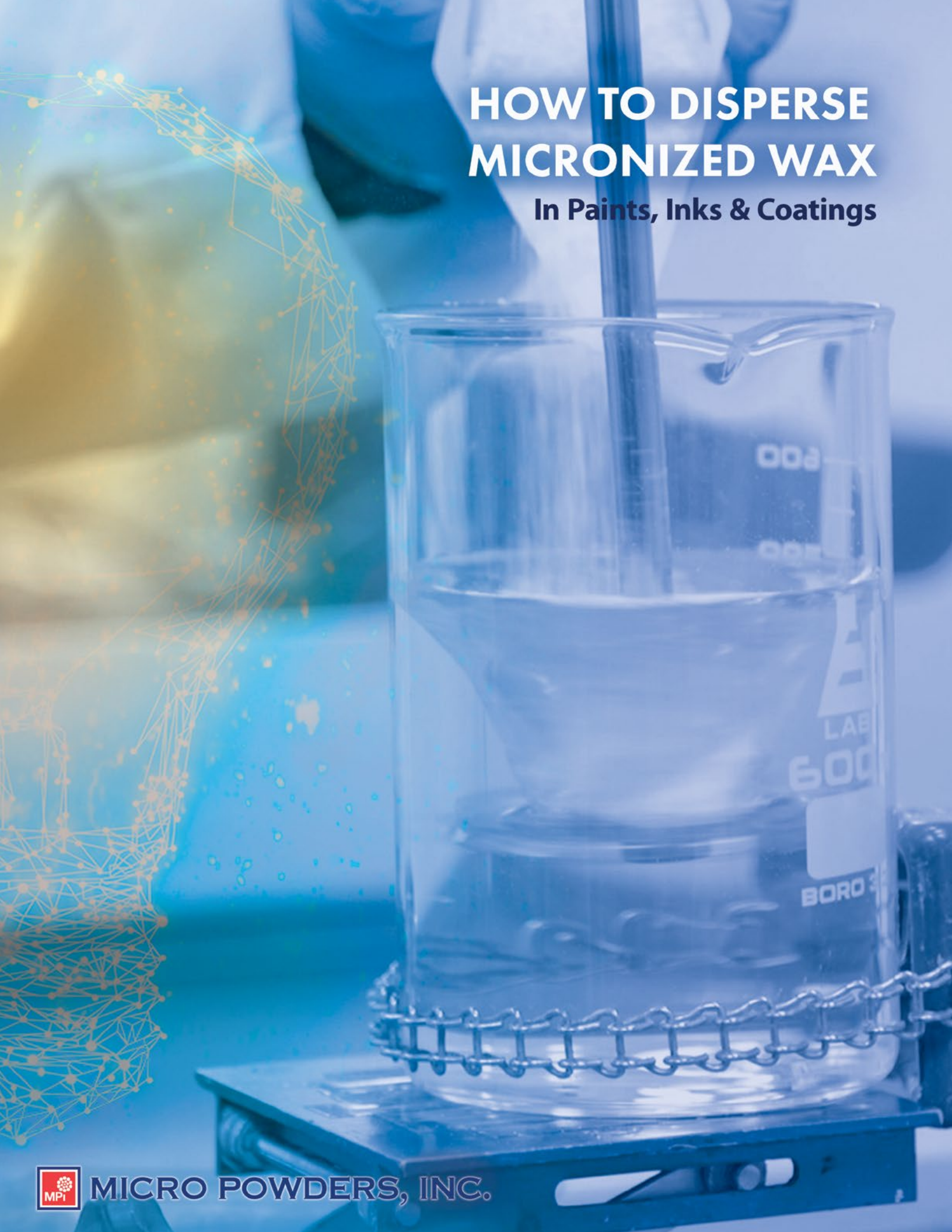


HOW TO DISPERSE MICRONIZED WAX

In Paints, Inks & Coatings

MICRO POWDERS, INC.

INTRODUCTION

Micro Powders manufactures micronized wax powders, many of which are based on polymers that have low surface energies. It is important to understand the proper techniques to use when incorporating micronized powders into a coating. To successfully "wet" the wax particles, the liquid used requires a lower surface tension than the surface energy of the wax. The term "wet" or "wetting" refers to completely dispersing individual micro-fine particles into a liquid medium.

- **Solvent based**
- **Water based**
- **Energy curable**
- **100% solids and reactive systems**

GENERAL CONCEPT

It is generally recommended to avoid adding micronized wax directly into the final liquid formulation, as this typically will lead to poor wetting, insufficient dispersion, agglomerated wax particles, coating defects, and poor end use performance. It is usually difficult to wet out a small percentage of dry wax in a large batch of liquid material. Ideally, a concentrated dispersion is first prepared using the wax powder and one or more components of the coating formulation. The appropriate amount of this pre-dispersion is then added to the final coating.

UNDERSTANDING WAX DENSITY

The density of a wax additive affects how the wax behaves once dispersed into a liquid. If the density of the wax is lower than the density of the liquid, the wax will want to rise to the surface and float. If the density of the wax is higher than the density of the liquid, the wax will want to sink to the bottom. Examples:

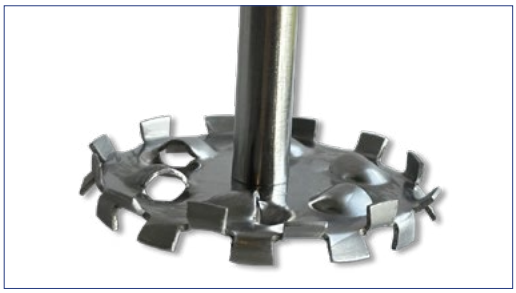
Wax Type	Density	Formula Type	Result
Polypropylene	0.89	Water based (density 1.0)	Float
Carnauba Wax	1.00	Water based (density 1.0)	Stable
PTFE	2.20	Water based (density 1.0)	Sink

Viscosity will affect the rate of this flotation or settling; higher viscosity systems will respond more slowly than lower viscosity systems. Formulators should be aware of this when preparing pre-dispersed wax compounds since the homogeneity of the dispersed wax can change over time.

Our product recommendations take this phenomenon into account to recommend the best product for your specific application (where possible). Many of our newer products have been designed with densities slightly over 1.0 to optimize in-can stability in most types of coating systems.

DISPERSION TECHNIQUE

For best results, it is recommended to use a high speed impeller disk such as a ConnBlade type ITT to provide sufficient shear energy to wet and disperse the wax and to break down any agglomerates that may be generated during the dispersion process. The effective shear energy is dependent on the shear rate and viscosity. Using an impeller disk that provides pumping action will give circulation of the total mass and wet out the particles more thoroughly.



In the laboratory, dispersion of dry wax can be achieved with a disk tip speed of 1,000 – 1,500 feet per minute (FPM), or around 5 – 7 meters per second (m/s). In a production environment, a tip speed of 4,000 – 5,000 FPM, or around 22 – 26 m/s, is a good target.

SOLVENT BASED SYSTEMS

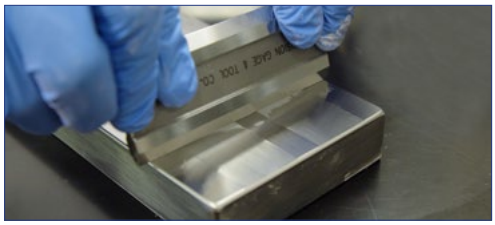
Since the surface tension of solvent based liquids is typically low, it is relatively easy to disperse micronized wax powders into these types of formulations. Although it may be more efficient to prepare a concentrated pre-dispersion using one or more of the solvent based formula components, it may also be possible (with efficient mixing) to add micronized waxes directly into the final coating.

It is important to note that when dispersing a micronized wax (especially grades based on lower melting polymers such as synthetic wax or carnauba wax) into a solvent based formulation, the formulator should use caution so as not to soften or dissolve the wax.

Overheating the dispersion can cause the micronized wax to become soluble and possibly recrystallize as it is cooled to room temperature. The dispersion temperature should be kept below 40 °C (104 °F) to prevent it from dissolving. Also, the use of aromatic or other strong solvents can lead to similar issues with dissolution and recrystallization, so avoid these solvents where possible with lower melting waxes. In fact, many solvent based coating formulators prefer to avoid lower melting wax grades because of these potential production issues, instead opting for a more temperature-robust polyethylene wax additive.

The following is a typical procedure for making a stable wax pre-dispersion in a solvent based system:

65%	Solvent (such as alcohols, esters, glycols, etc.)
	Add wax slowly while mixing
35%	Micro Powders wax additive
	Mix until fully dispersed (~10 minutes)



As the wax is dispersed, the viscosity of the mixture will decrease, and the final dispersed material will have a glossy appearance. Add the appropriate amount of this pre-dispersion to provide the addition level you desire in your coating.

WATER BASED SYSTEMS

Since the surface tension of water based liquids is high, it can be difficult to disperse micronized wax powders directly into these types of formulations. It is highly recommended that a concentrated pre-dispersion be prepared using one or more of the water based formula components.

There are several different ways to prepare a wax pre-dispersion for a water based formula:

Method A: Disperse 40-50% of the micronized wax into a water/surfactant mixture (For example, Micro Powders' Microspersion® EZ-2 is a formulated surfactant package that is ideal for this approach at a 4% addition level)

Method B: Disperse 20-30% of the micronized wax into a water based resin or vehicle (with defoamer if needed)

The following are two typical procedures for making a stable wax dispersion in a water based system:

Method A - Using Surfactants	
45.5% 4.0% 0.5%	Water Microspersion® EZ-2 (or other surfactant mixture) Defoamer (Solvay Rhodoline® 643 or other)
	Mix water and additives before adding in wax (~5 minutes) Add wax slowly while mixing
50.0%	Micro Powders wax additive Mix with high shear energy until fully dispersed (~20 minutes)

Method B - Using Resins	
60.0% 0.5%	Water based vehicle (acrylic, PUD, etc. - typically around 40% solids) Defoamer (Solvay Rhodoline® 643 or other)
	Mix vehicle and additives before adding in wax (~5 minutes) Add wax slowly while mixing
25.0%	Micro Powders wax additive Mix with high shear energy until fully dispersed (~20 minutes)
14.5%	Water (add last)

As the wax is dispersed, the viscosity of the mixture will decrease, and the final dispersed material will have a glossy appearance. Add the appropriate amount of this pre-dispersion to provide the addition level you desire in your coating.

For further information on extending shelf stability of a waterbased wax dispersion, please read "How to Stabilize a Water Based Wax Dispersion" at the end of this guide.

ENERGY CURABLE SYSTEMS

Follow the procedure and formula for solvent based systems, replacing the solvent component with monomer and/or oligomer from the energy curable formula. Then add the appropriate amount of this pre-dispersion to provide the addition level you desire in your coating. Use caution during the dispersion process to avoid excessive shear and/or heat development that may cause the energy curable materials to be affected.

100% SOLIDS & REACTIVE SYSTEMS

Follow the procedure and formula for solvent based systems, replacing the solvent component with a low viscosity component from the 100% solids formula. Low reactivity diluents such as polyaldimine or exempt solvents such as propylene carbonate are useful in preparing pre-dispersions. Then add the appropriate amount of this pre-dispersion to provide the addition level you desire in your coating.

HOW TO VERIFY A WELL-DISPERSED WAX

It is relatively easy to check a coating or pre-dispersion to ensure that the wax particles have been fully dispersed and wetted out. A grind gauge such as a NPIRI gauge is the easiest way to evaluate the material. Micro Powders wax products have a NPIRI gauge specification that you can use as a reference point. Other gauges such as a Hegman may also be useful in confirming the degree of dispersion. Of course, the best way to check will be to prepare a laboratory scale batch of your coating and evaluate the dried film for surface uniformity, gloss level, COF, or other surface property measurements.

HOW TO STABILIZE A WATER BASED WAX DISPERSION

As discussed earlier, many micronized wax grades will float in a water based system because the particle density is lower than that of water (1.0). This flotation process occurs faster in lower viscosity systems. To slow this process, the viscosity of a wax dispersion can be increased through the incorporation of a thickening agent. Polyacrylic acid thickening agents or xanthan gum can be used.

DEFOAMING

If the wax dispersion process generates excessive foam, a defoamer can be added, typically at 0.5%. Rhodoline® 643 (Solvay) is an effective defoaming agent for water based wax dispersions.

THE MICROSPERSION® OPTION

If your application is water based, and you would prefer to purchase pre-dispersed wax in an aqueous liquid form, Micro Powders offers many of our most popular products in Microspersion® form. These high solids nonionic wax dispersions are easy to add directly to your final waterbased formulation.

HAVING PROBLEMS?

Micro Powders' Technical Support Staff are just a phone call or e-mail away and are always available to help. If you are facing challenges with your application and need our assistance, please contact us.