Proper dispersion of pigments is necessary to optimize the physical and appearance properties of coatings. Inefficient or unstable dispersion of pigments will cause:

- Poor color development and opacity problems
- Batch-to-batch color inconsistency problems
- Processing problems in highly filled systems
- Poor distinctness of image (DOI), flow & leveling and gloss properties

In general, it is difficult to achieve proper dispersion of pigments in a powder coating system due to the lack of a liquid medium. Thus, pigment dispersion efficiency will depend on several variables such as:

- Extruder type: Mechanical energy exerted by the extruder helps to break-up pigment clumps into smaller particles within the coating system. Its efficiency will depend on the type and settings of the processing equipment used. (i.e. single or twin screw extruder)
- Viscosity and rheology of the coating: Higher viscosity and rheology coatings generally impede the break up of pigment clumps.
- Pigment & Filler loading level: Higher levels are more difficult to disperse because there is less resinous material available to wet and disperse the pigment particles.

In addition, even if the variables above allow good pigment dispersion, flocculation during extrusion or curing of the powder coating may still occur (Figure 1). This is due to the attractive forces (e.g. electromagnetic, van der Waals, hydrogen bonding) that cause pigment particles to move together to minimize their surface energy.

**Phases of Pigment Dispersion**

![Phases of Pigment Dispersion](Image)

**Powdermate EX2015**

Powdermate EX2015 is a polymer based surfactant wetting agent & dispersion stabilizer. It assists in wetting the pigment surface, allows encapsulation by the binder and prevents flocculation thereby promoting a stable pigment dispersion.

With a stable pigment dispersion, powder coating formulators can:

- Achieve full color development: More stable color tones can be produced even when using pigment combinations.
- Obtain full color development with less pigment: A complete and stable dispersion of the pigment particles allows improved color strength/depth and thereby, creates the possibility of reducing the pigment level.
- Overcome batch-to-batch color inconsistency.
- Improve overall properties of the coating such as opacity, DOI, gloss and flow & leveling due to excellent dispersion of formulation ingredients, specifically pigment particles.
**How Powdermate® EX2015 works:**

Powdermate EX2015 is an amphoteric material with opposite charges on the molecule’s polar ends. As illustrated in Figure 2, one end is attracted to a pigment particle and the other end extends into the binder. This creates a barrier from other surrounding pigment particles which provides stabilization and prevents flocculation.

![Figure 2](image)

**Use Level:**

The use level of Powdermate EX2015 will vary depending on the surface area and oil absorption rate of the individual pigments, resin types and viscosities, as well as other formulation ingredients such as flow and leveling additives, etc.

The suggested use level range is 0.5 - 2.0% on total formulation weight, depending on the coating system. It is generally recommended not to exceed 4.0% by total weight.

Troy’s Powder Coating Laboratory has derived a test method to:

1. Explore the pigment dispersion stability within a powder coating.
2. Optimize the use levels of Powdermate EX2015 for specific formulations & pigment combinations.

This easy-to-use test method is called the Optimization Test Method. It allows formulators to identify instability of the pigment dispersion and determine the optimum use level of Powdermate EX2015 for the specific formulation quickly.

When used at the optimum level Powdermate EX2015 provides:

- Excellent batch-to-batch color consistency
- Excellent color development and opacity
- Easier processing
- Improved gloss, DOI, and flow & leveling

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Optimization Test Method

Step 1.
A 3” x 6” (7.62 cm x 15.24 cm) aluminum panel is clamped to a hot plate and the temperature is set at 175 ºC.

Step 2.
Approximately 2 grams of finished powder coating is melted and spread on the panel to produce a smooth even film.

Step 3.
A spatula is then used to shear (rub) part of the smooth film while the rest of the film is allowed to level.

- The sheared portion of film is referred to as a rub-up.

Step 4.
The test panel is then quickly removed from the hot plate and is cooled to room temperature.

A colorimeter is used to measure the color of each test panel/sample

- L*, a* and b* values of the rub-up
- L*, a* and b* values of the un-sheared

Step 5.
The following Δ values are then calculated:

- ΔL = L*rub-up – L*smooth
- Δa = a*rub-up – a*smooth
- Δb = b*rub-up – b*smooth

Results
A completely stable pigment dispersion gives:

- ΔL = L*rub-up – L*smooth = 0
- Δa = a*rub-up – a*smooth = 0
- Δb = b*rub-up – b*smooth = 0

Please visit www.powdermate.com to request a copy of the Technical Data Sheet or to request samples.

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