

Formulation guideline: SILVERDREAM Moonlight 50 IL in nail varnish systems

The SILVERDREAM product line represents a unique line of metallic pigments for nail enamels. SILVERDREAM Moonlight 50 IL offers an intensely radiant mirror effect.

SILVERDREAM Moonlight 50 IL is composed of very thin aluminium pigments and isopropyl alcohol. These extremely fine pigments possess a very plain surface and need therefore optimized incorporation methods to achieve bold metallic gloss in nail polish.

The visual effect can be influenced by optimized shear rate, shear time as well as adjusted pigmentation of SILVERDREAM Moonlight 50 IL in suitable nail varnish systems.

Fundamentals of dispersion technology – Principles:

- At dispersion speeds (20 – 30 m/s) the impeller imparts high velocity to the material.

$$\frac{\text{RPM} \times 3.14 \times \text{blade diameter (in meter)}}{60} = V_p \text{ (m/s)}$$

- The high velocity creates a turbulent zone of intense flow. Rapid hydraulic attrition is accomplished in this zone, utilizing shear and impact energy. This turbulent zone is normally within 2-5 cm of the blade diameter, and 75% of the kinetic energy is applied within this zone. The vortex should end where the shaft meets the blade.

1. Blade consideration

(Table 1):

		Result	Advice
Blade speed	Too slow	Long dispersion times and possibly material settling	Good dispersion speed is between 20 – 30 m/s Shaft rpm x 3.14 x blade diameter (in meters)
	Too fast	Air in the product, temperature might rise and low quality dispersion	
Blade sizing	Too small for the vessel	Insufficient product movement and settling of solids will occur in addition to longer dispersion times	The blade diameter should equal 1/3 the vessel diameter.
Blade positioning	Too low in the vessel	Will decrease product flow and create dead spots that will not be mixed	The blade should be 1 to 1.5 diameters off the bottom of the tank. Good laminar flow will result in a good vortex.
	Too high in the vessel	Will decrease product flow; Will allow some solids to settle and not get dispersed. Induction of air.	
	vessel too big and blade is off center	Difficult to get a good dispersion	To minimized the vortex in the vessel with a lift mounted disperser,

			move the blade 1/2 to 1 blade diameter off center (with the machine off)
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2. Vessel consideration:

The product level should be equivalent to the vessel diameter. The side of the vessel is equal to the product level, plus 20% added for free-bore.

- vessel diameter = product level
- Straight side = product level + 15 – 20% free bore

3. Vortex consideration:

Beyond the turbulent zone, the movement becomes laminar. This flow divides at the vessel wall, assuring complete circulation of the entire batch. Turbulence does not interrupt flow pattern. The laminar flow is what causes the vortex seen in the process.

- Choked vortex: can be caused by poor blade position, slow speed or adding dry materials to quickly
- Ideal vortex: allows observation of the shaft almost to the blade

B. Optimized conditions for SILVERDREAM Moonlight 50 IL in nail polish base

Please note: below only recommendations are cited, final parameters have to be optimized on each nail polish system in dependence of the equipment used. Using ideal conditions the visual metallic effect can be improved.

Table 2:

	Recommendation	
Impeller	High shear blade	For homogenous and rapid dispersion.
Shear rate	7 – 12 m/s	If the mechanical stress to the pigments is too high, the pigment particles might break, resulting in loss of lustre or change in shade.
Shear period	10 – 12 minutes	To long shear time could also corrupt the pigments => leads to loss in gloss and change in shade.
Pigmentation	2 – 3 %	The higher the pigmentation the better bold metallic gloss effect.
Pre-dispersion of the paste in solvent	Pre-dispersion of aluminium pigment paste with nail polish containing solvents like butyl acetate, ethyl acetate or isopropyl alcohol	De-agglomeration of the aluminium pigment paste. The pigment slurry could be add to the nail polish system.

Combinations with other raw materials

The resulting metallic effect depends on a suitable nail polish system, for example special nail bases for metallic pigments.

Physical Properties

- SILVERDREAM pigment pastes should be kept at room temperature in a tightly closed container to avoid loss of solvent.
- SILVERDREAM pigment pastes are not allowed to be used in water-based or water containing systems due to their reactivity in contact with water (hydrogen formation).

Regulatory limitations

No use restrictions for aluminium pigments in nail polish application in EU/Japan and US.

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