Paint Defects

Mike Praw

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Bulk Paint Defects

Surfactant Stripping

Syneresis / Settling

Flocculation / Seeding / Shock

Surfactant Stripping

Surfactant from one raw material in a paint has a higher affinity to another raw material and migrates to the other raw material or bulk liquid.

Caused by improper surfactant type or loading in a coating.

Raw materials are stable by themselves but become unstable in a coating.

Can happen if surfactant starved raw materials are added to a coating.

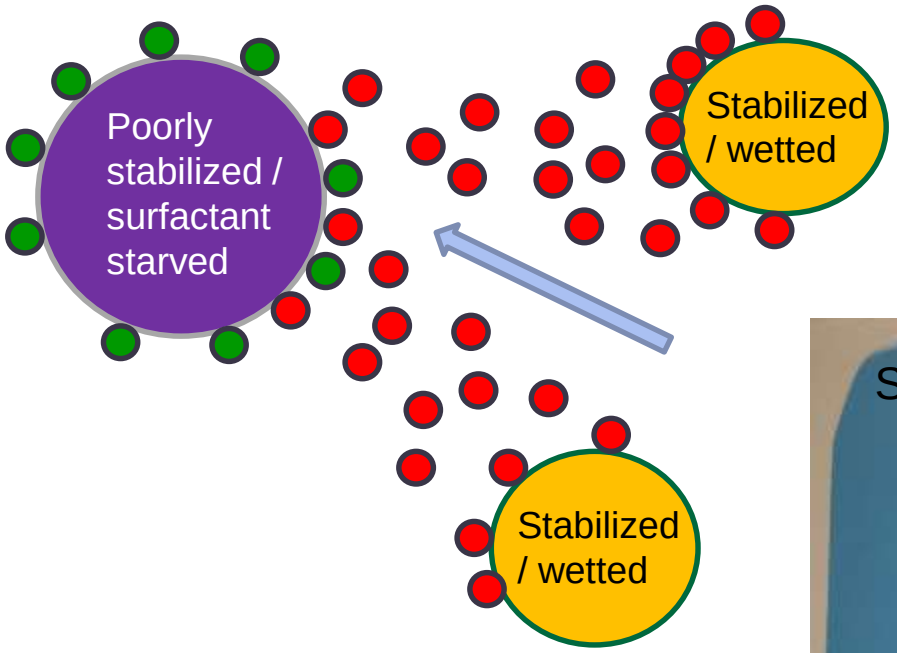
Make sure raw materials have the proper type and quantity of surfactants, especially if you make them.

Add additional “universal” surfactant to the formulated coating for stability.

Make sure HLB of surfactants matches the raw material.

Surfactant Stripping

Surfactant Stripping



Syneresis

Stratification of liquid layers in a coating.

Caused by different compatibilities and densities of liquids in a coating.

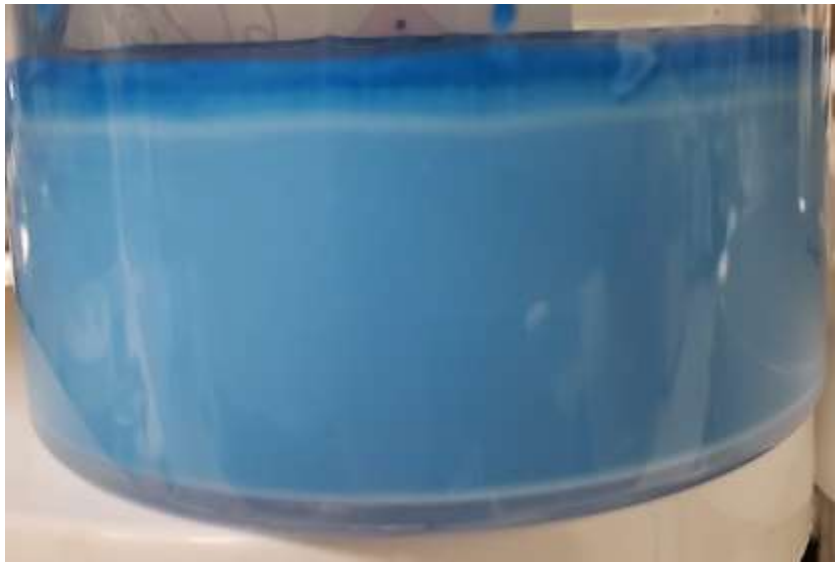
Common in lower solids coatings where you have higher amount of water / solvent or high gloss paints with a lot of free resin.

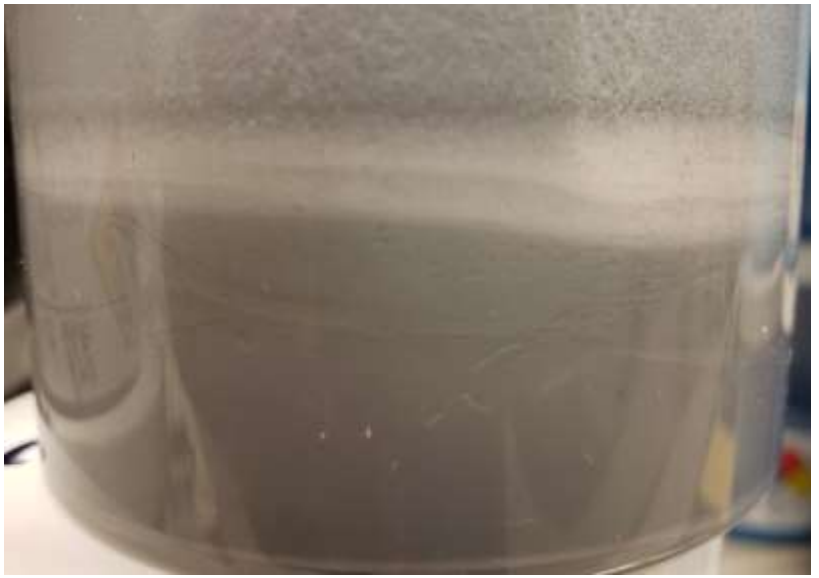
Rheology package (low shear region) is not optimized for the coating.

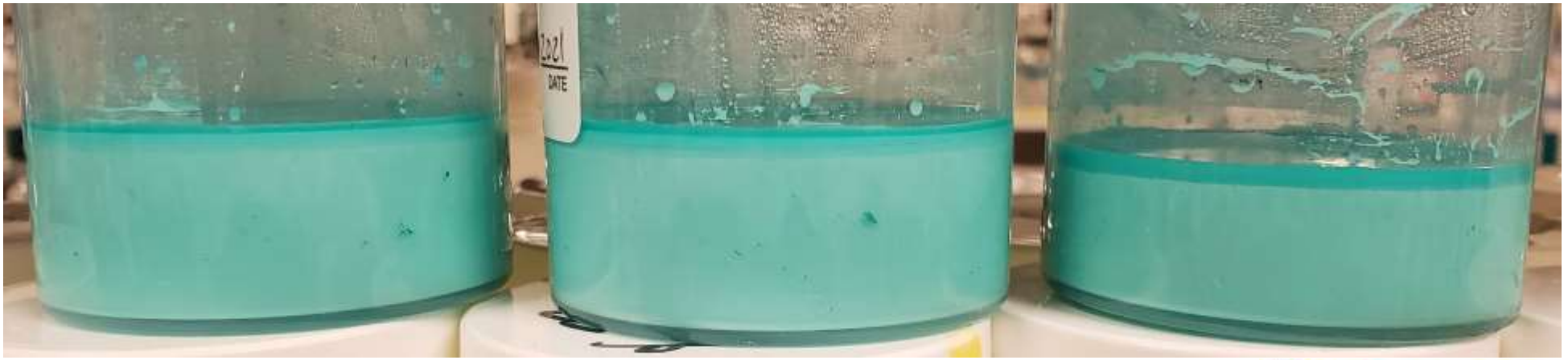
Increase surfactants to aid in compatibility (not too much).

Adjust rheology package to give better low shear stability (increased low shear viscosity).

Syneresis







Settling

Solids settle out of the bulk liquid.

Caused by different densities of liquids and solids in a coating.

3 main factors – viscosity, density difference and particle size (Stokes' Law).

Rheology package (low shear region) is not optimized for the coating.

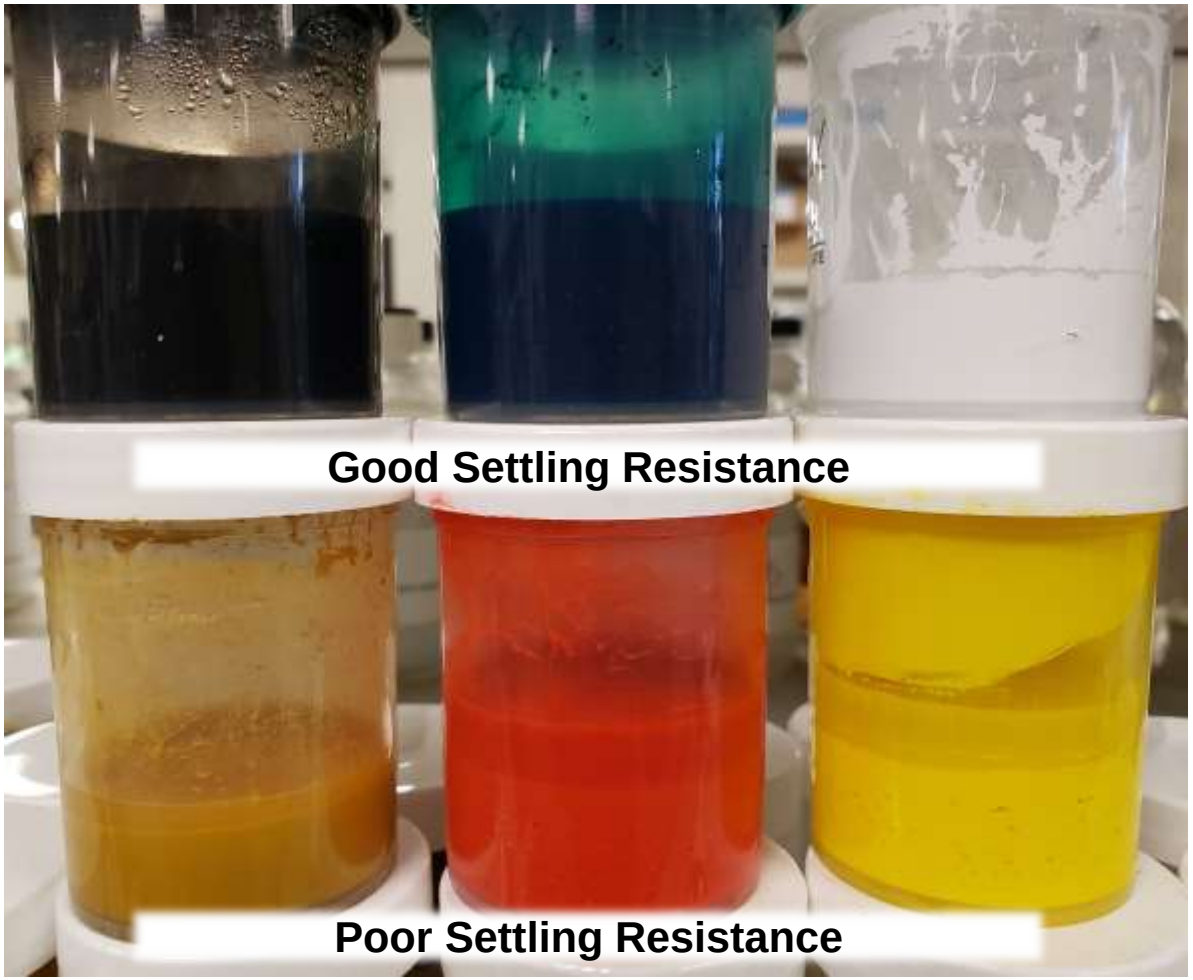
Pigment not stabilized and it aggregates/agglomerates.

Avoid hard settle, soft settle may be acceptable.

Modify surfactants (dispersants) to stabilize the pigment dispersion.

Adjust the rheology package to give better low shear stability (increased low shear viscosity).

Settling



Shock

Properly stabilized pigment dispersion has external forces applied and causes it to destabilize.

Caused by a borderline stable system.

Cooling or reducing the dispersion too quickly shocks the dispersion, and it becomes unstable.

Let warm dispersions cool slowly before letting it down.

Reduce (let down) dispersions gently with agitation.

Additional or different surfactants may be needed depending on partition factors of the dispersant.

Seeding / Flocculation

An unstable dispersion allows the pigment particles to aggregate or agglomerate. Seeding is when the pigment and other raw materials combine.

Flocculation is when it is only pigment.

Caused by the dispersant not stabilizing the pigments.

Often the addition of another raw material will interact with the dispersant causing the instability.

Add stabilizing surfactants before the let down.

Additional or different surfactants may be needed depending on the raw materials added.

Watch for surfactant / rheology modifier interactions.

Seeding / Flocculation

Seeding

Flocculation

Application Paint Defects

Flooding / Floating

Mud Cracking

Blooming / Hazing

Flooding

The pigment concentration is uniform at the surface and substrate but not through its thickness (horizontal gradient).

Caused by improperly stabilized / flocculated pigments.

During cure, water volatilizes, and hydrophilic pigments are carried to the surface with the water.

Lower solids coatings more susceptible due to increased water evaporation.

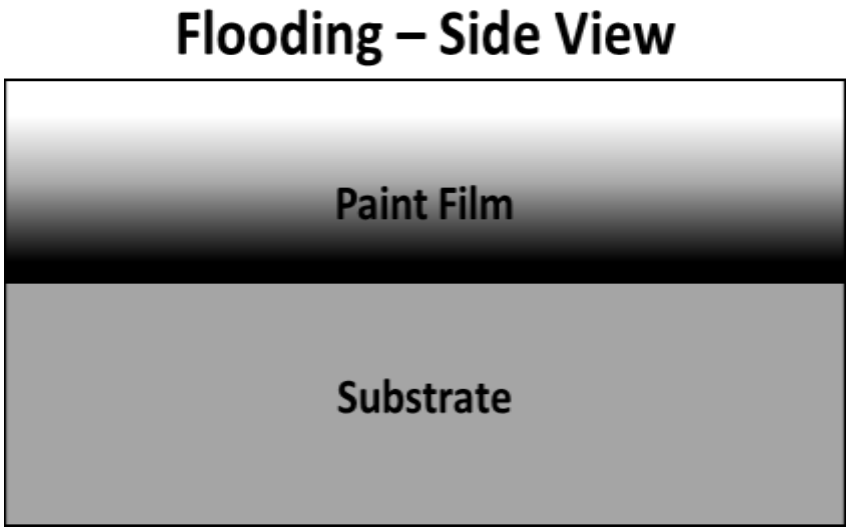
Incompatibility of the emulsion and pigment dispersion increases flooding.

Adequate dispersant to stabilize the grind is needed to prevent flocculation.

Decreasing surface tension and increasing viscosity, limit pigment mobility.

Surfactants can help compatibilize the emulsion and pigment dispersion.

Flooding


Flooding – Side View
Paint Film
Substrate


Little / No Flooding
Flooding

Floating

Flow currents (Bérnard Cells) form during water evaporation and pigments move to the surface in columns (vertical gradient). You see concentration differences at the surface.

Caused by improperly stabilized / flocculated pigments.

During cure, the water volatilizes, and pigments are carried to the surface.

HLB and size of the pigment determine mobility.

Incompatibility of the emulsion and pigment dispersion increases floating.

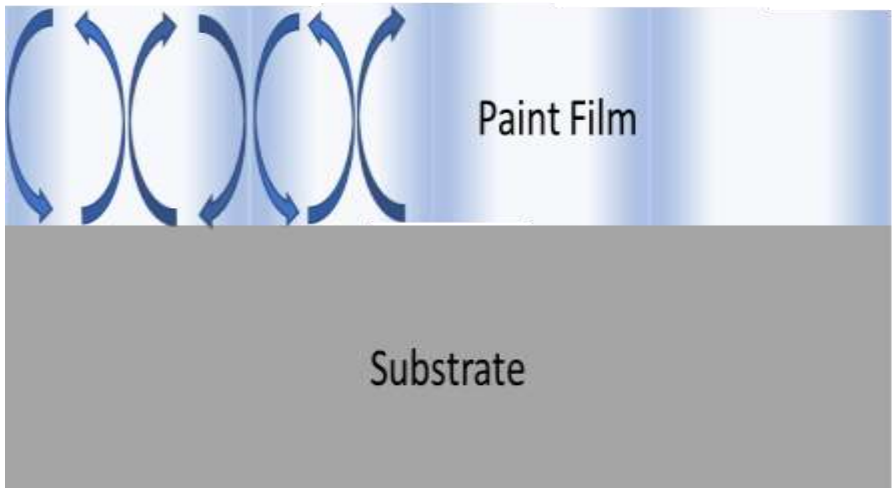
Use adequate dispersant to stabilize the grind and compatibilize components.

Increasing viscosity and solids will help limit pigment mobility.

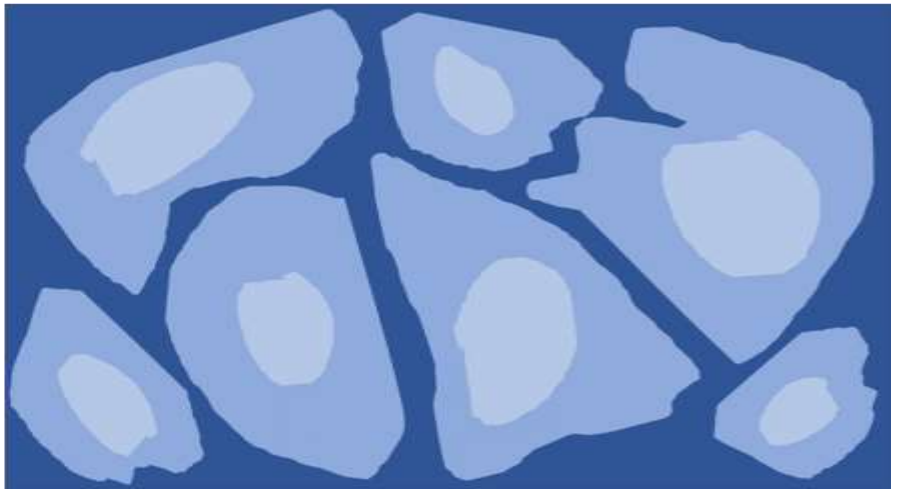
Leveling agents can turn floating into flooding and not solve the issue.

Floating

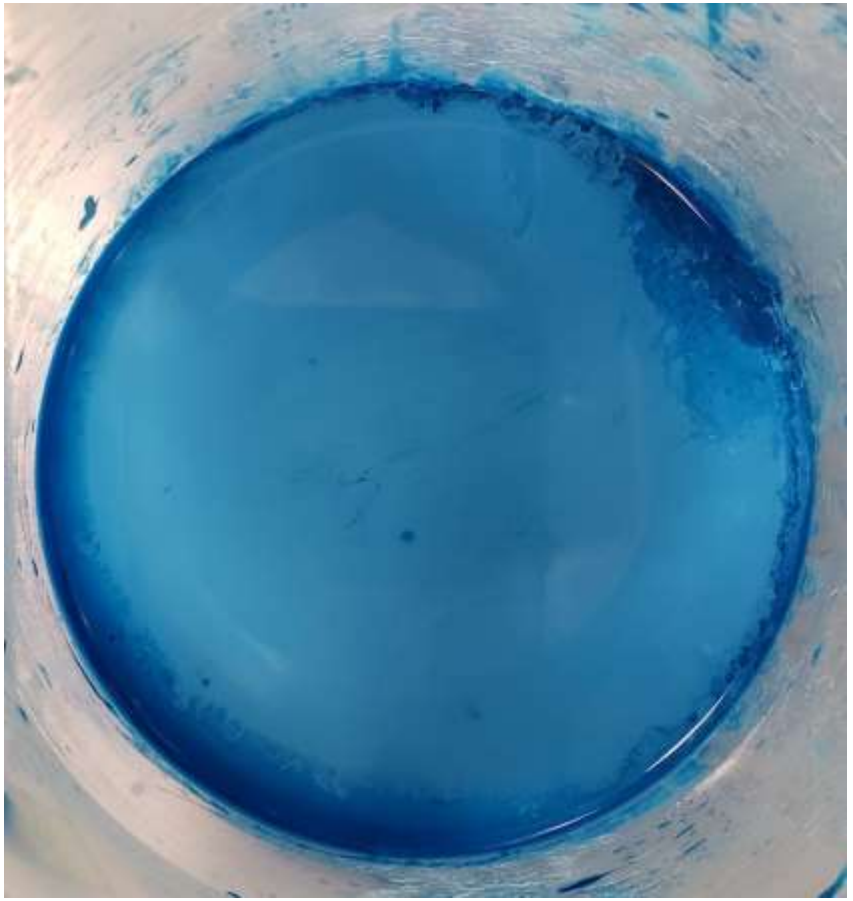
Floating – Side View



Floating – top View



Flooding and Floating



Mud Cracking

Deep cracks appear in the dry coating.

Caused by applying too thick a coating or over a porous surface.

Common in high PVC / low solids coatings flat coatings.

Can happen if areas of the coating dry faster than other areas (over plaster versus paint).

Seal surfaces to limit porosity.

Lower coatings application film thicknesses or increase coatings solids.

Additional surfactant or humectant in waterbased formulas or slower tail solvents in solvent based formulas can help prevent mud cracking.

Mud Cracking

Blooming / Hazing

Incompatible raw materials move to the surface and create areas of different appearance or gloss. Small or irregular areas are known as blooming, while a general appearance over the film is know as hazing.

Caused by too much of a low surface tension, incompatible raw material, usually defoamers.

During or after cure, the incompatible raw material moves to the surface.

Inability of the coating to incorporate these raw materials.

Adequate surfactant to stabilize and compatibilize components.

Increase level of flow and leveling agents.

Lower amount of a more incompatible defoamer that is better dispersed (smaller particle size) to produce smaller defects (ideally too small to see).

Blooming / Hazing

Film Paint Defects

Alligatoring

Scrub Resistance / Water Sensitivity

Burnishing / Mar

Alligatoring

Crack pattern resembling an alligator skin

Caused when a topcoat is applied over an undercoat that is not dry or when a rigid paint is applied over a paint or substrate that is more flexible or dimensionally unstable.

Effect of aging of a paint that eventually makes it more rigid than the substrate or previous coats.

- **Plasticizers in latex paints migrating into a previous layer of paint or the substrate.**
- **Alkyd paints oxidizing or 2K paints curing over time and becoming more rigid.**

Use a more flexible coating over dimensionally unstable substrates.

Lower crosslinking level in reactive coatings systems.

Use a lower Tg resin instead of a plasticizer and a high Tg system.

Alligatoring

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Water Sensitivity / Scrub Resistance

Decreased water resistance of the film.

Caused by use of water sensitive raw materials.

Common in deep bases and other coatings with high levels of surfactants or hydrophilic plasticizers.

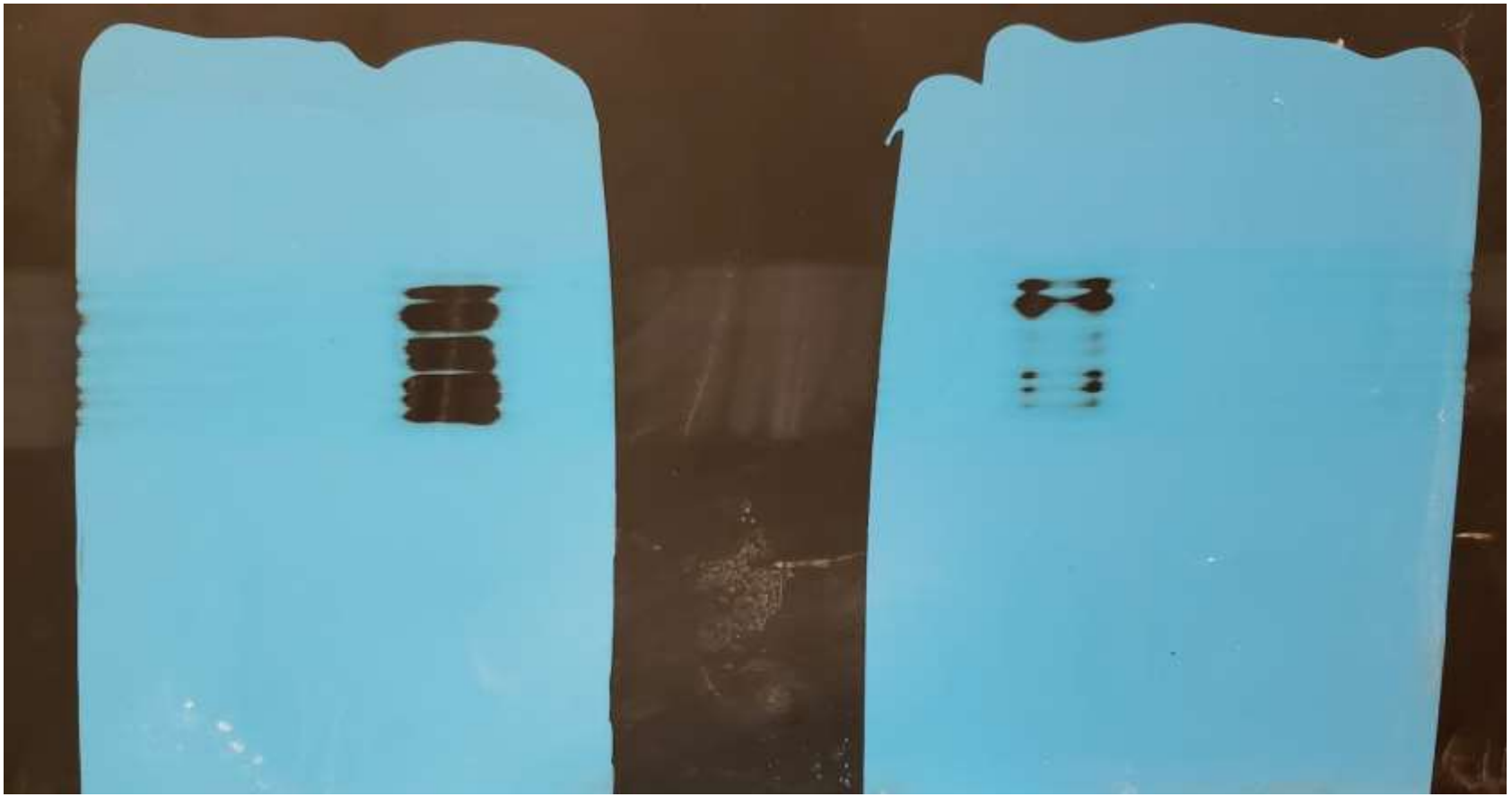
Can be worse if the surface is very hydrophilic and wicks water into the film.

Use more hydrophobic raw materials.

Lower levels of surfactants help (avoid surfactant starved situations).

Additional surface modifiers (waxes…) to lower water permeation into the film / surface waterproof the film.

Water Sensitivity / Scrub Resistance



Burnish / Mar

Poor resistance of the surface of a coating to physical damage.

Caused when the coating uses extenders that are too soft (talc..) or in systems near or over the Critical Pigment Volume Concentration.

The surface of the coating is damaged, and gloss or color change is visible.

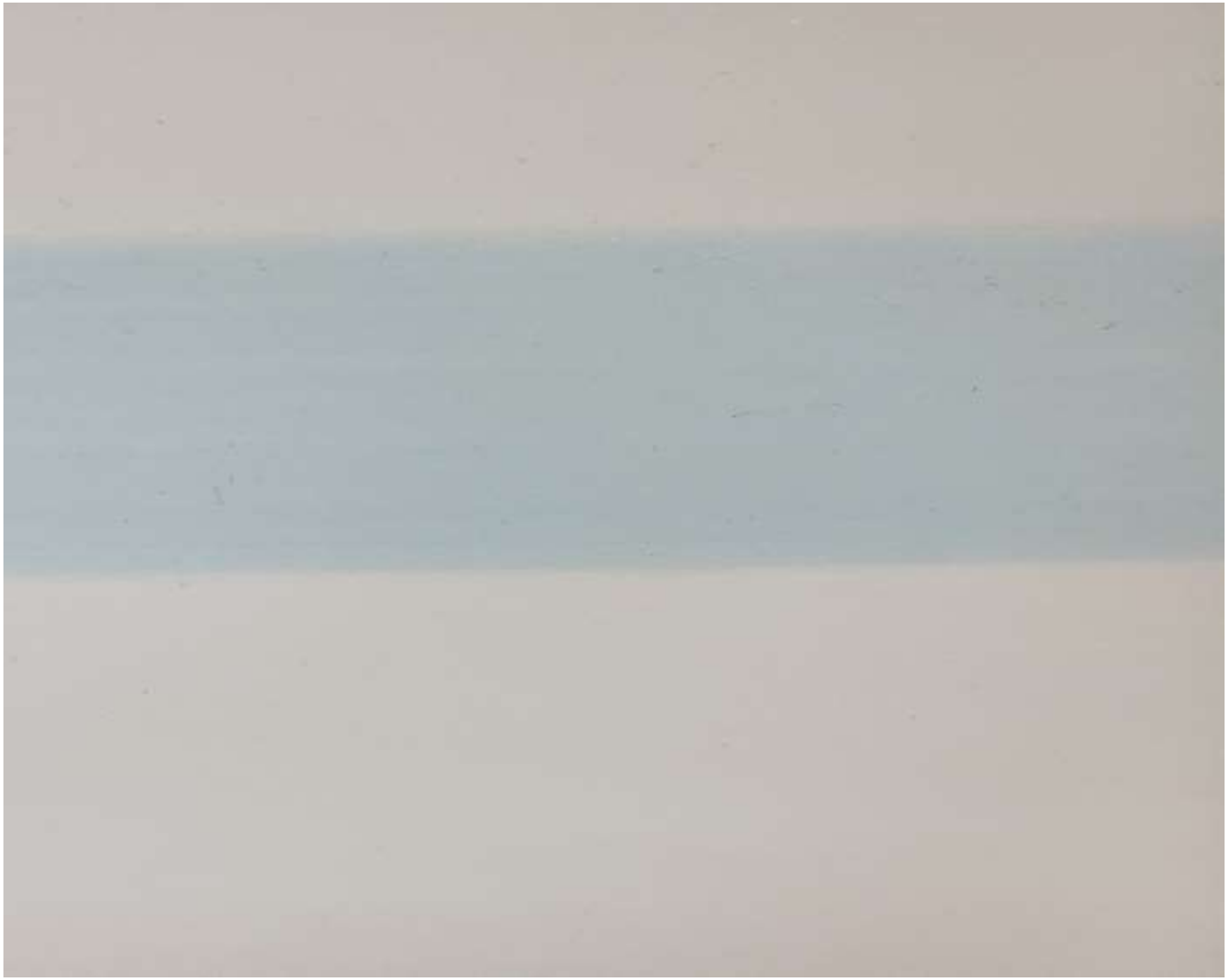
Common in inexpensive flat paints.

Use harder extender pigments.

Lower the PVC of the coating so all pigment is covered and there is excess resin.

Use slip and mar additives to help protect the coating's surface.

Burnish / Mar



Conclusion

A stable and robust formulation is the most important factor in making quality paints! While it takes time and preparation, it is easily obtainable.

Questions?

Mike Praw
Senior Scientist Applications
Michael.praw@us.Indorama.net
281-719-7507

Thank You!

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