

Developments in Thin Milled Aluminum Flake Technology for Waterbased Coating Systems



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Agenda

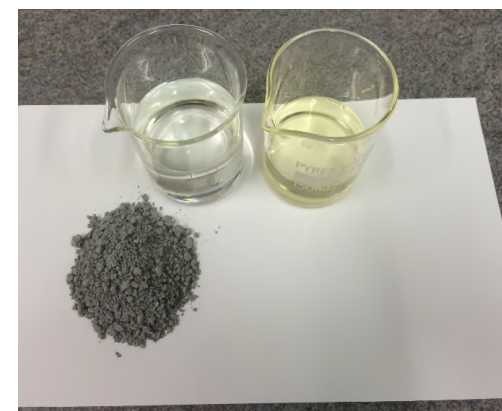
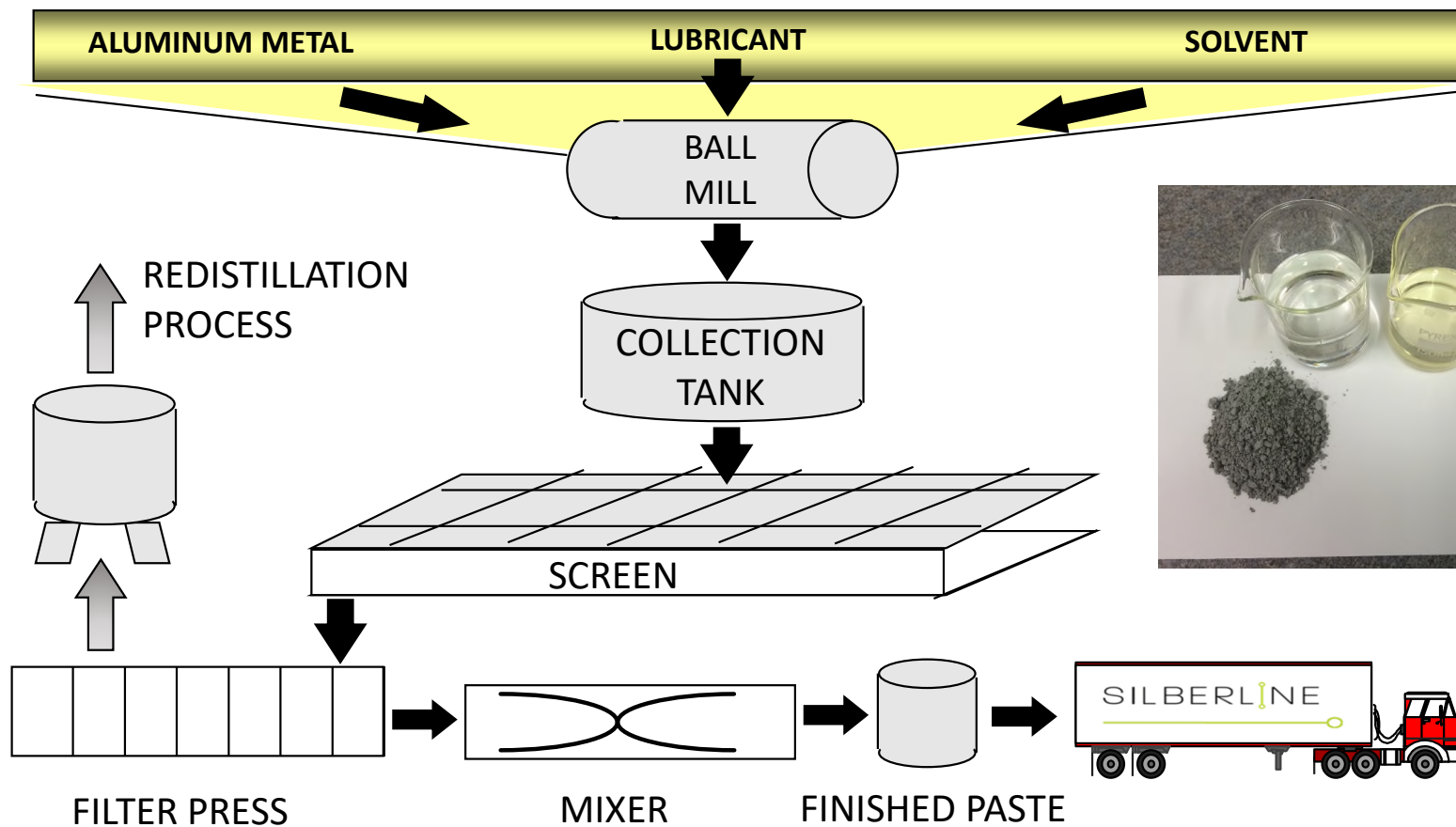
SILBERLINE THIN MILLED FLAKE TECHNOLOGY

- Basics of Thin Milled Flakes
- Current Product Technology
- Available Surface Treatments & Delivery Forms
- Color & Performance in WB Coating Systems
- Recent Technology Advancements
- Review & Wrap Up

Basics of Thin Milled Flakes



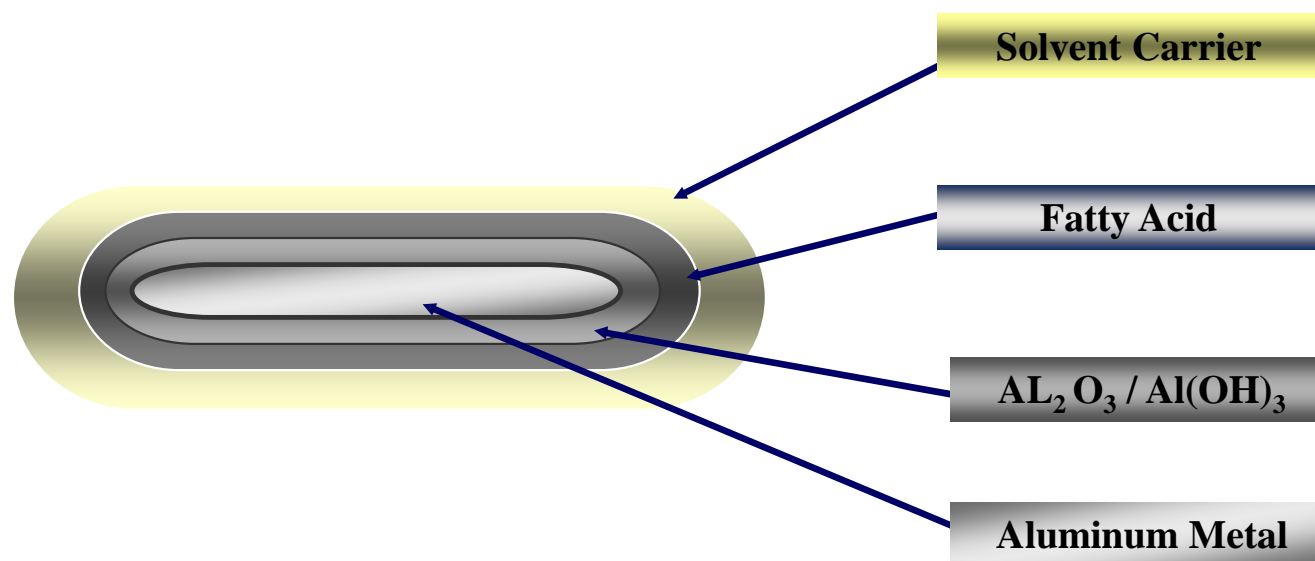
Manufacturing Process – Thin Milled Flakes





Basic Thin Milled Flake Structure

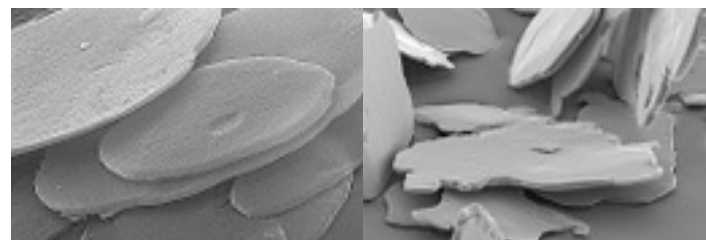
For Use in Solventborne Paint Systems



SEM Comparison of Aluminum Flakes

Geometry & Thickness Breakdown

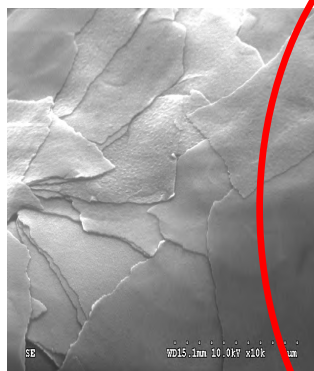
Shape



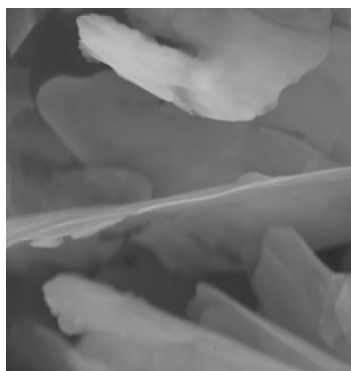
Lenticular
"Silver Dollar"

Conventional
"Corn Flake"

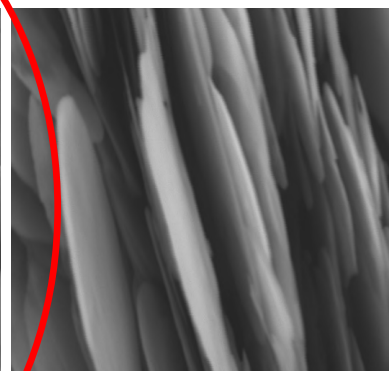
Thickness



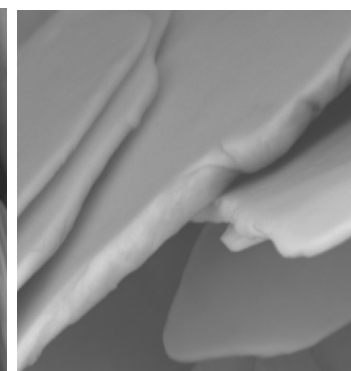
VMF (15 – 50 nm)



Liquid Metal (80 – 120 nm)



Traditional milled (120 – 400 nm)



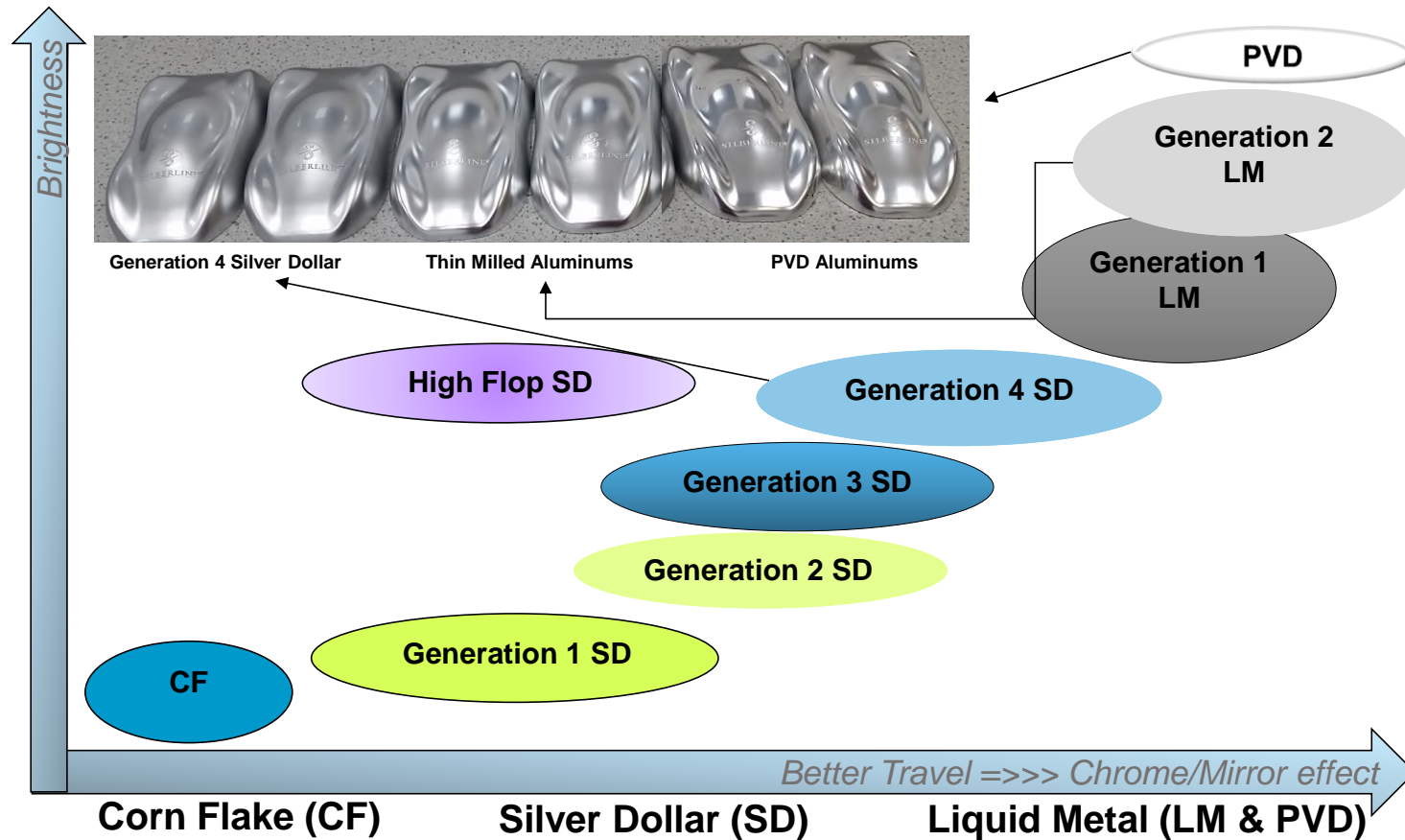
Degradation Resistant (>400 nm)

Current Product Technology



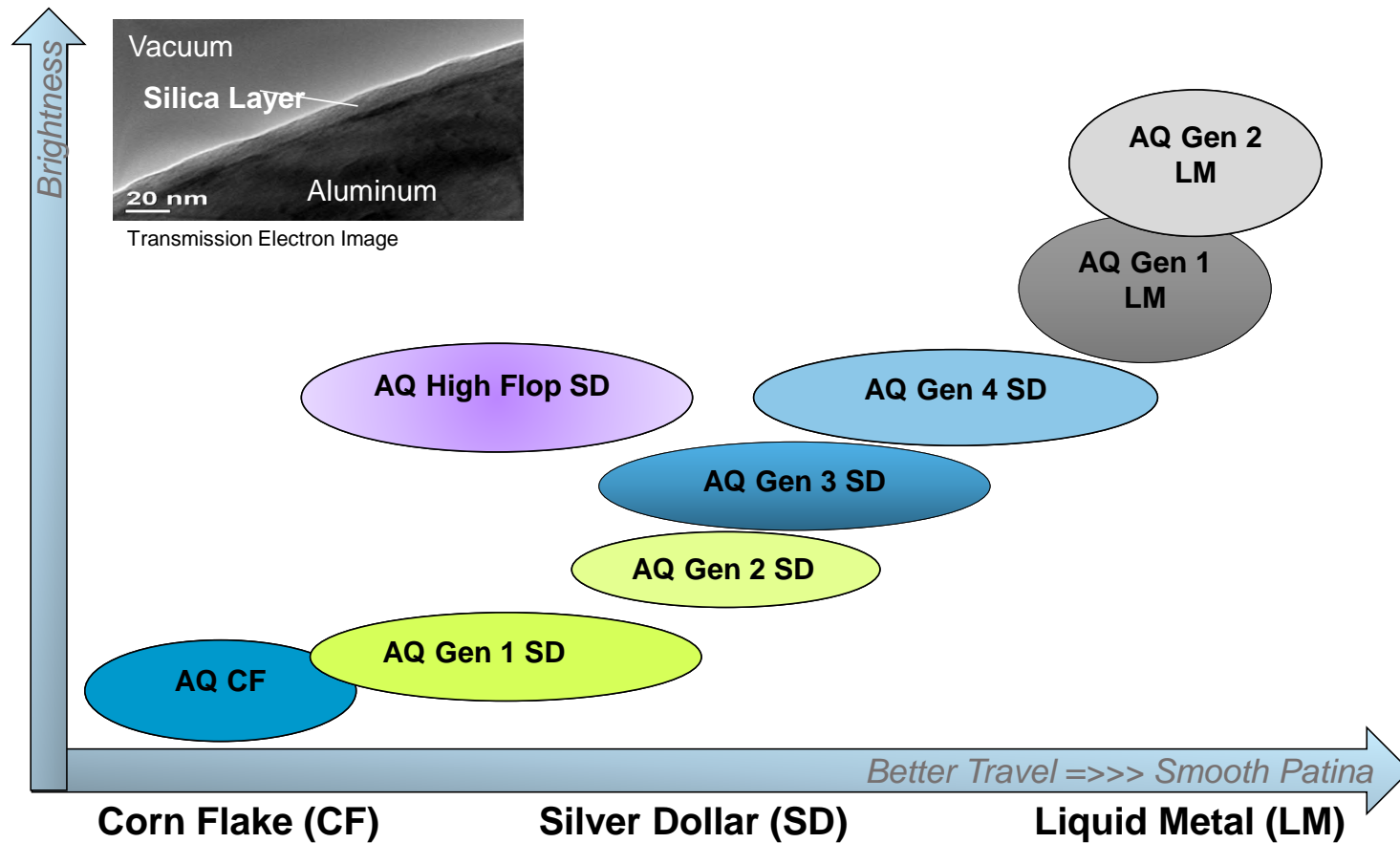
Product Portfolio - Complete

SILBERLINE Complete Untreated Aluminum Flake Line



Silica – Silane Treated Product Portfolio - Complete

SILBERLINE Complete Silica Treated Aluminum Flake Line



Available Surface Treatments & Delivery Forms

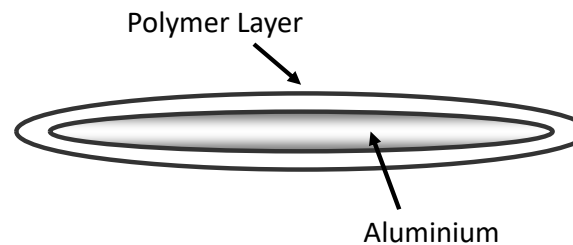
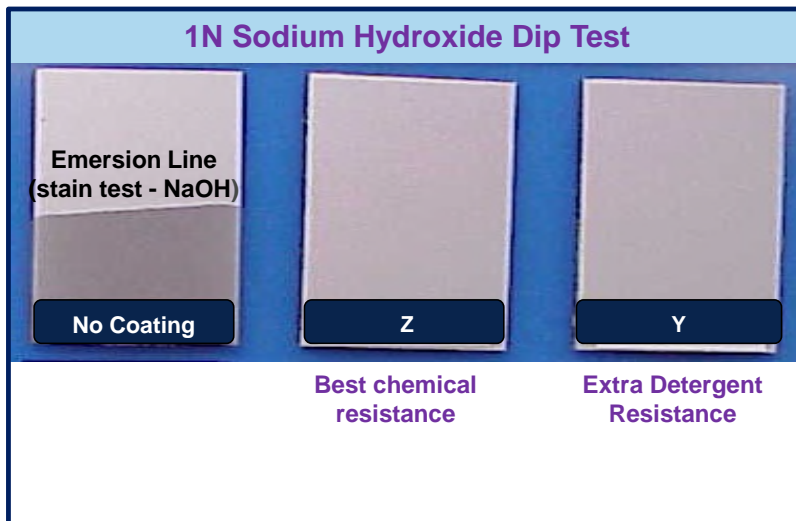
Acrylic Coating for Solventborne Monocoat

High Chemical Resistance Thin Flakes – Paste Form

- Y & Z Acrylic Encapsulation
- Y = Co-polymer for increased detergent resistance (appliances)
- Z = Homopolymer with excellent chemical and rub resistance



For **monocoat interior** (no topcoat!!)
Solventborne only (not water stable)



- Available in 11, 15 and 20µm LM Flakes
- *** Can also be dried for use in powder coatings

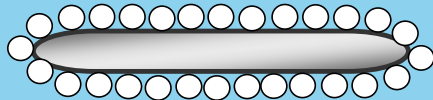
Phosphate Treated Thin Milled Flakes

General Industrial & Graphic Arts – Paste & Granule Forms

INORGANIC

Passivation

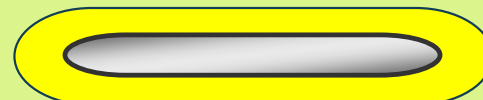
Sacrificial electrochemical mechanism
– particle adsorption to flake surface



ORGANIC

Passivation

Evenly coated organic phosphate
barrier prevents water attack –
covalent bonding





X & XS for Powder & Liquid Coatings

Solvent Free Dried Powder Form for both Powder and Liquid Coatings

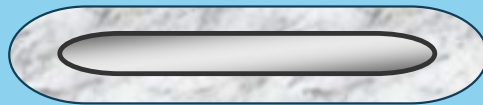
X Technology

Inhibition Mechanism

Thin, uniform silicon dioxide shell for stability and bonding performance

Surface Treatment

No Silane Treatment



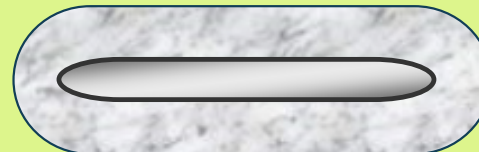
XS Technology

Inhibition Mechanism

Thick, uniform silicon dioxide shell for improved chemical and rub resistance

Surface Treatment

No Silane Treatment



AQ Technology for WB/SB Coatings

Paste Form PM Ether, PnB, BG Carriers

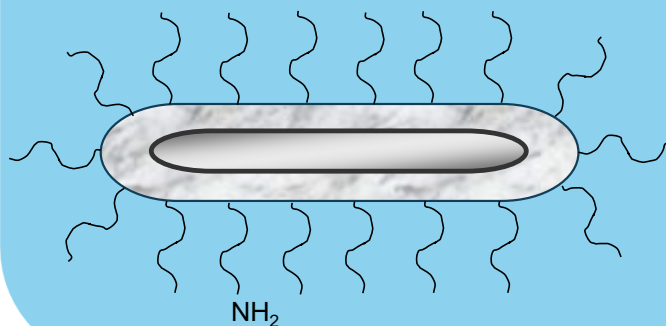
AQ Standard

Inhibition Mechanism

Thin, uniform silicon dioxide shell for gassing and blender resistance

Surface Treatment

Silane treatment for adhesion promotion and dispersion (hydrophilic)



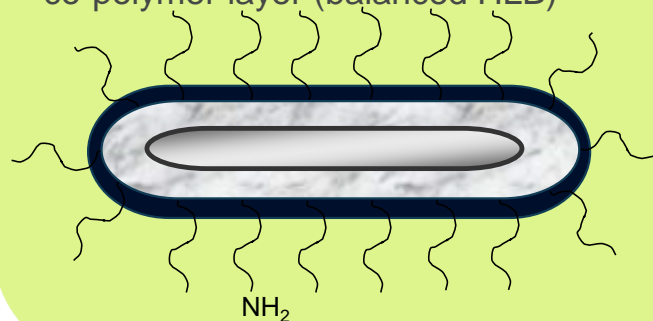
AQ Alternate

Inhibition Mechanism

Thin, uniform silicon dioxide shell for gassing and blender resistance

Surface Treatments

Silane treatment with additional alkoxy-functional / amine-functional co-polymer layer (balanced HLB)



Color & Performance in WB Coating Systems

Proper Formulation of Thin Milled Aluminums

The Do's and Don'ts

- Less is more when it comes to thin milled aluminums – *“a little goes a long way”*
 - Reduced aluminum loading will prevent overcrowding and give better orientation and travel
 - Typical slurry loading for aluminums may not work for thin milled flakes – high oil absorption can be an issue for proper dispersion - especially with high solids solvent systems
 - Better blender resistance at lower aluminum loadings

- Silica treatment is essential if shear resistance is required
 - Untreated paste will be severely damaged by shear and recirculation
 - Lower solids of WB systems yields almost no color issue with shear resistance
 - Long term stirring in WB systems (retained slurry) should be monitored for gassing – additional silica/silane can help this issue
 - Careful formulating should be used in high solids solventborne systems as blender resistance is lower

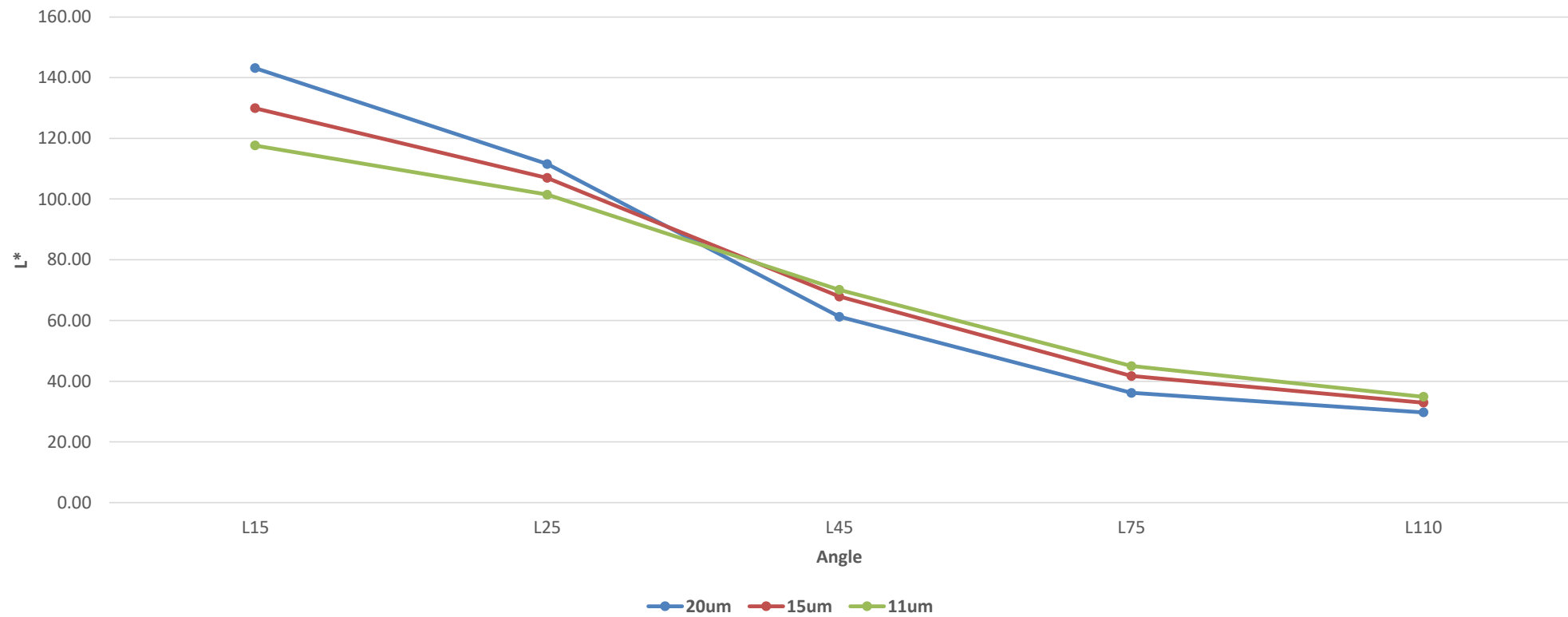
- Formulation for near-chrome is difficult in traditional exterior paint systems
 - High pigment load and low solids are not acceptable for exterior body paint systems
 - Reduced pigment loading coupled with lowest solids possible will yield better effect with improved adhesion/performance
 - Wheel coatings tends to give more freedom to get closer to PVD appearance



Color – OEM Bell Application

Various d50 Silica Treated Thin Milled Aluminum Flakes

Effect Of Particle Size on MT Color - 9% PWC WB OEM Bell

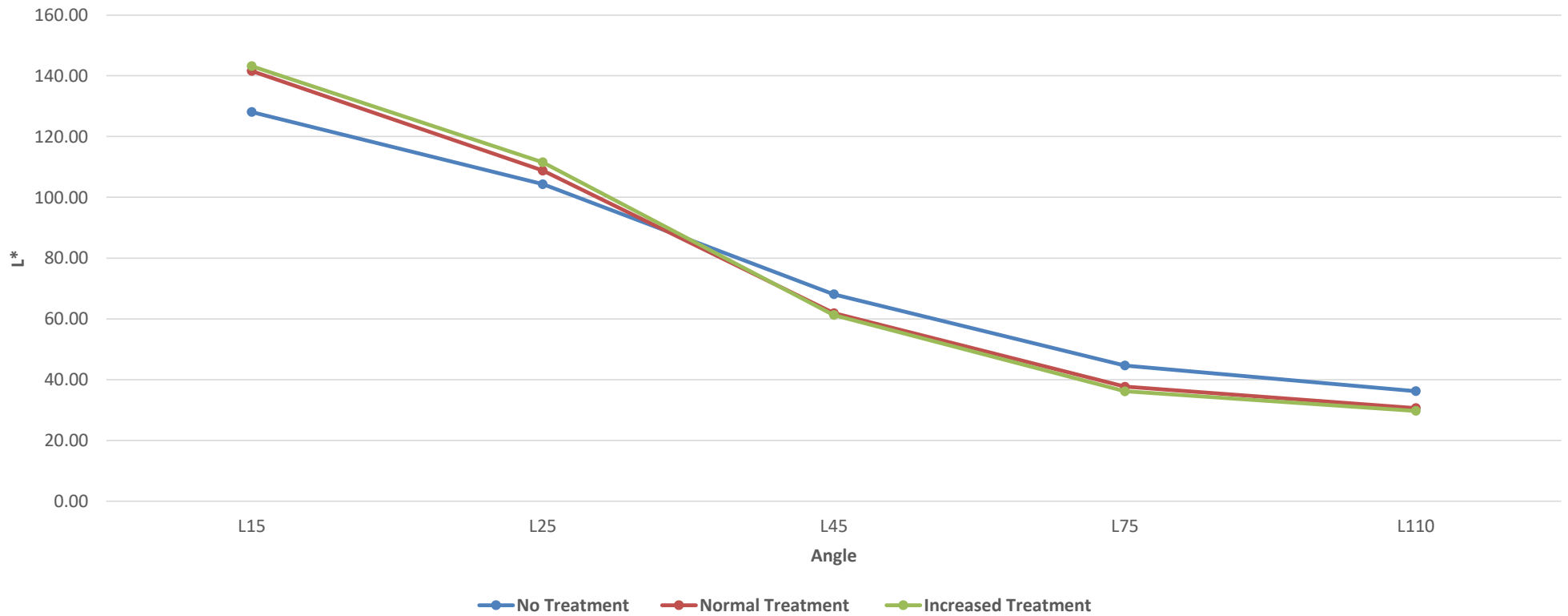




Color – OEM Bell Application

Various Silica Levels – 20µm Thin Milled Aluminum Flake

Effect of Silica Treatment on MT Color (20µm) – 9% PWC WB OEM Bell

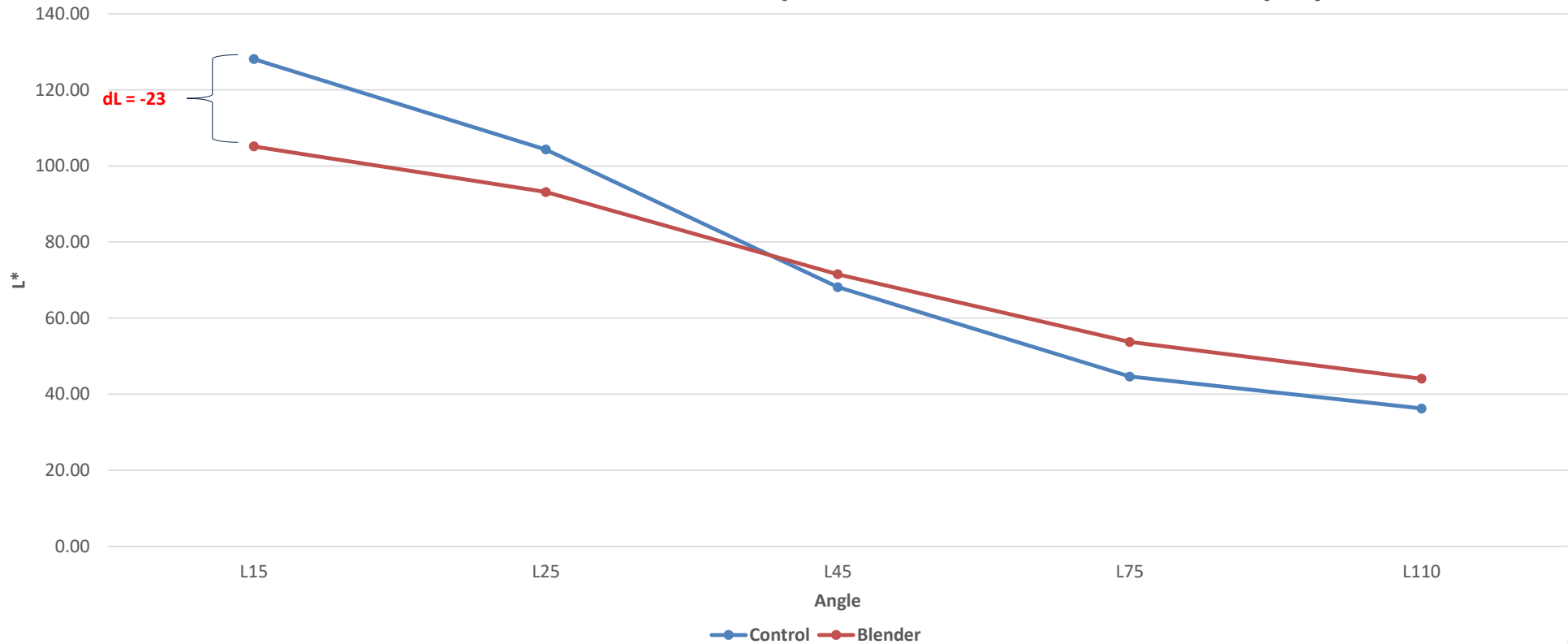




Shear Resistance – OEM Bell Application

20µm Thin Milled Aluminum Flake – *No Treatment*

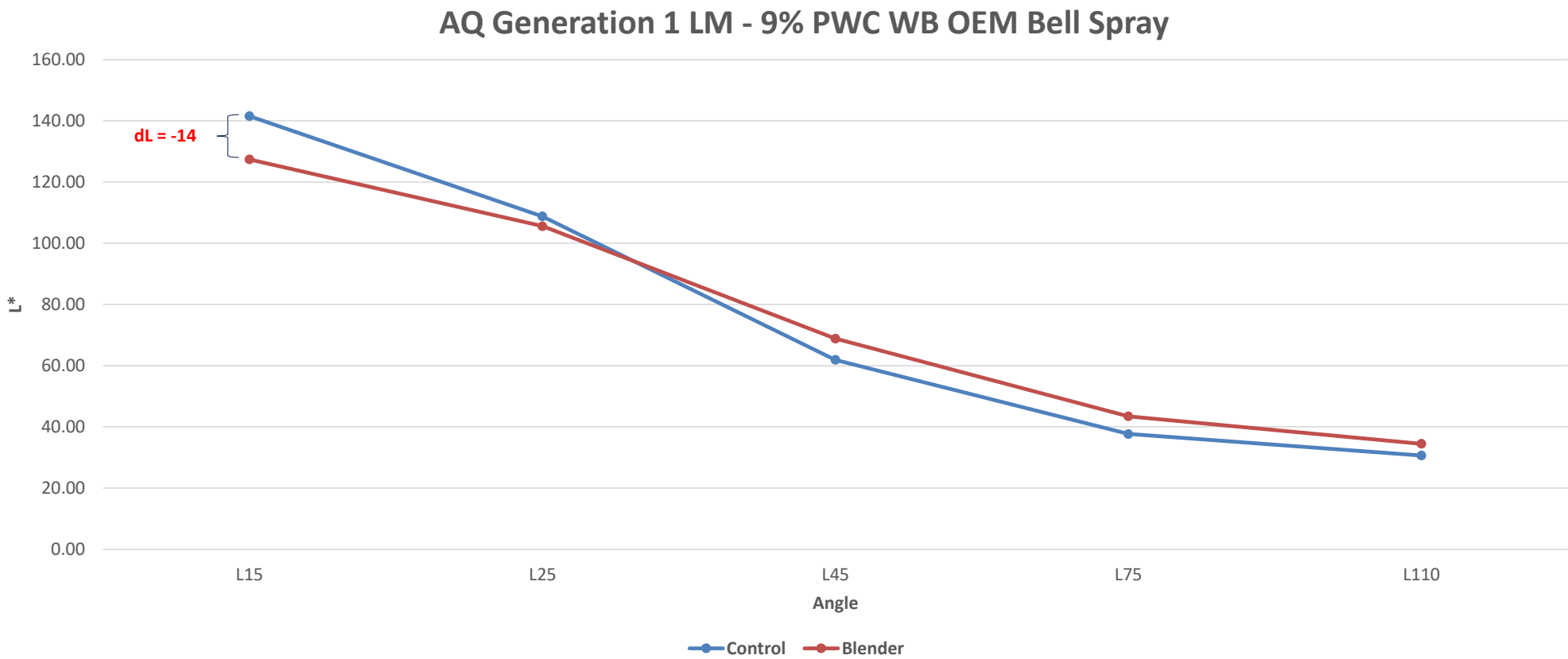
Generation 1 – 20µm LM - 9% PWC WB OEM Bell Spray





Blender Resistance – PPG OEM Bell

20µm Thin Milled Aluminum Flake – Normal Silica Treatment (~25nm Shell Thickness)

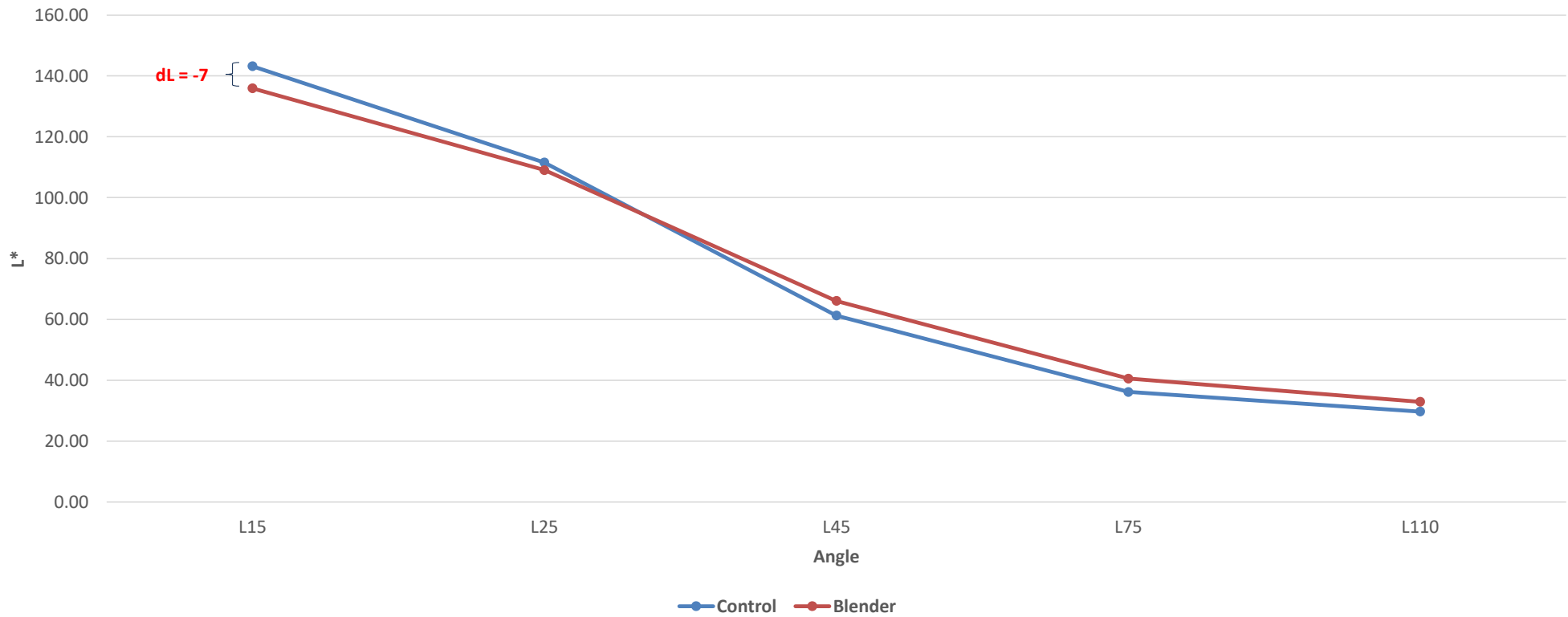




Blender Resistance – PPG OEM Bell

20µm Thin Milled Aluminum Flake – OEM Silica Treatment (~40nm Shell Thickness)

AQ Generation 1 LM - 9% PWC WB OEM Bell Spray

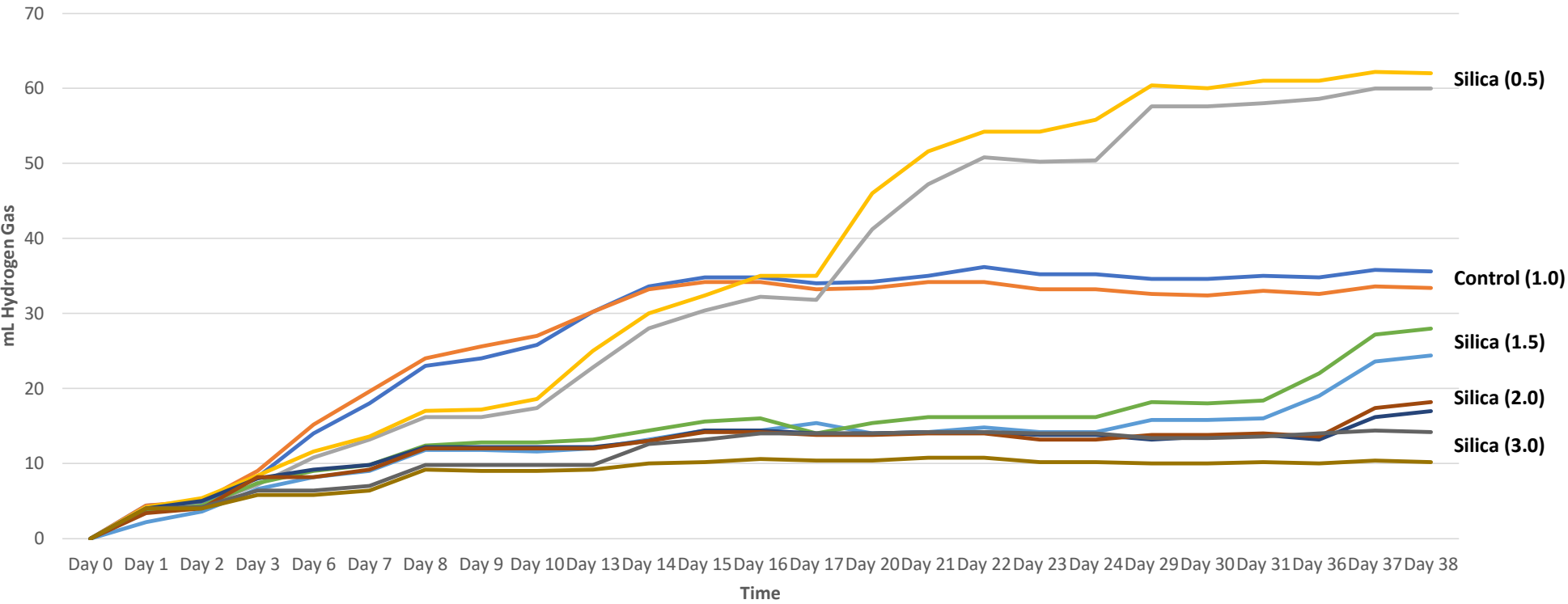




Gassing Resistance – WB Acrylic System

20µm Thin Milled Aluminum Flake – Various Silica Levels (~15 – 50nm)

Gas Evolution at *Various Silica Levels* – 20µm Thin Flake, 40°C Temp

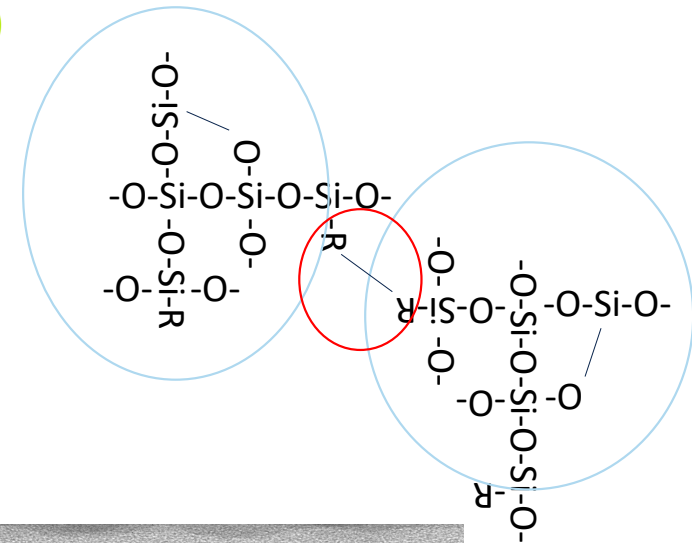
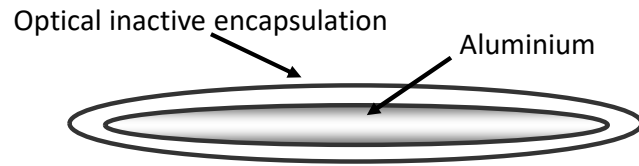


Recent Technology Advancements: Hybrid Encapsulation



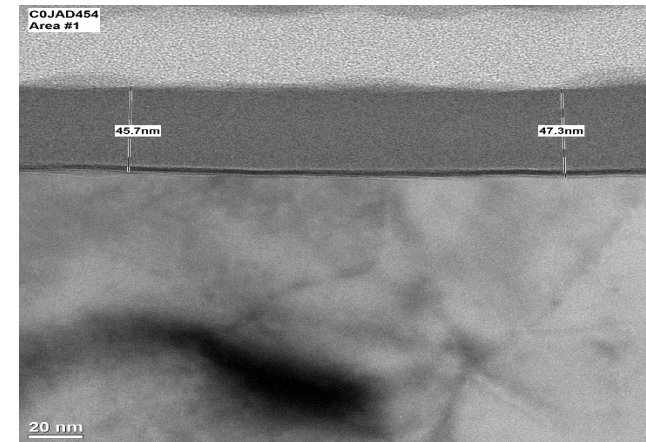
Hybrid Resin-Silica Encapsulation for PC & WB

SILBERLINE Unique Solution – **Cross-linked Encapsulation (Patent Applied)**



Key Features

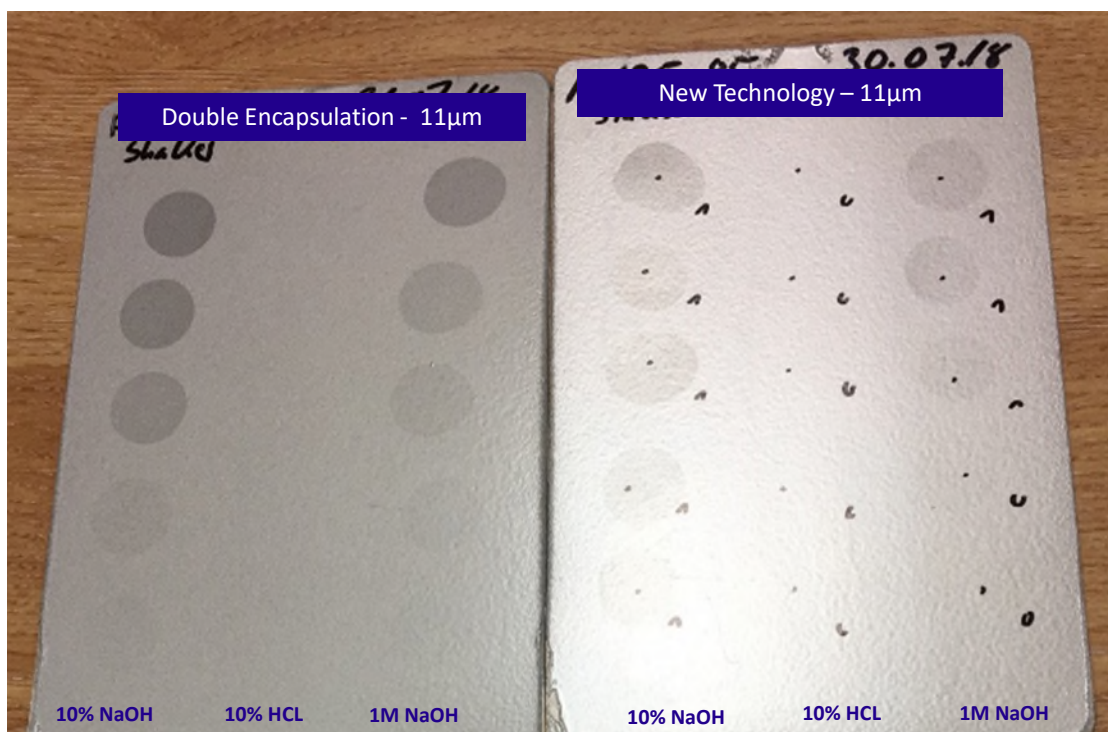
- Single cross-linked layer offers gassing and chemical resistance
- Excellent compatibility in most binder systems
- Extreme rub resistance in one-layer coatings
- Excellent applicability in powder
- Enhanced gassing resistance in liquid coatings
- Outstanding shear stability



AQ Hybrid Technology

Consistent **High-Density Hybrid** Encapsulation

Improved Chemical Resistance

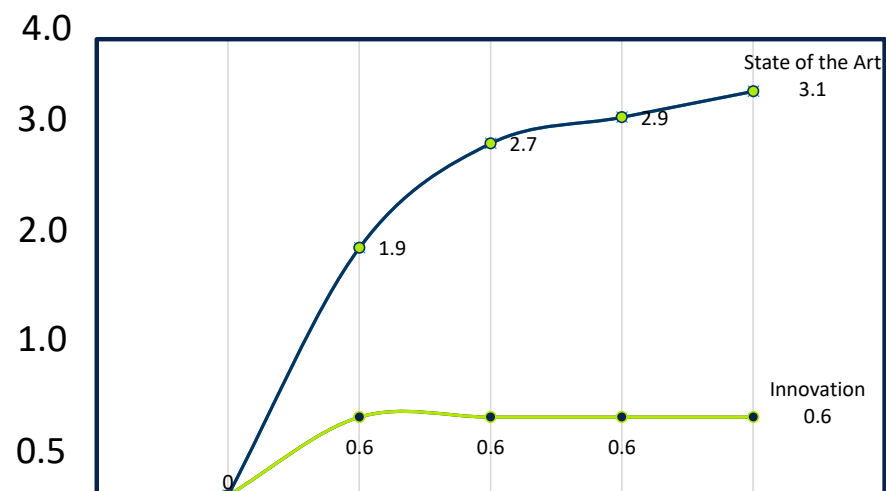


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Improved Gassing Resistance in WB Coatings

28 Day H₂ Gas Evolution @ 40°C, pH=9.0 (ml)

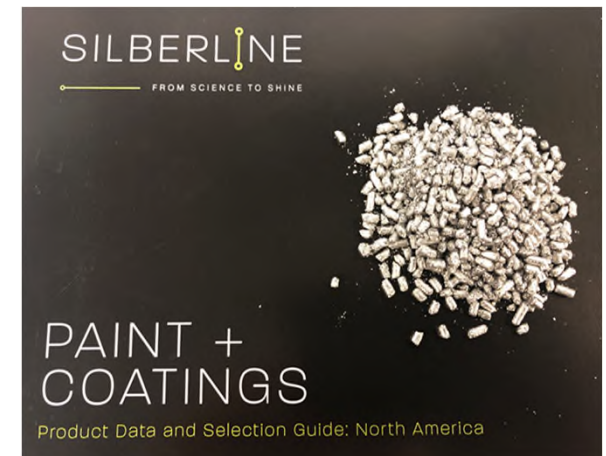


Recent Technology Advancements: Solvent Free AQ Granules

AQ Granules - Features & Benefits

SILBERLINE

- Soft, solvent free granule of silica encapsulated pigment
 - Zero VOCs
 - APEO Free
 - No Odor
 - High metal content
 - Non-Hazardous
 - Ease of handling
 - 2-year shelf life
- Not a resin carrier – combination of surfactants and dispersants
- 9 products have been selected for this technology
 - 3 Cornflakes
 - 3 Silver Dollars
 - 3 Ultra Thin Silver Dollars
- Suitable for air shipment – not regulated for transport or storage

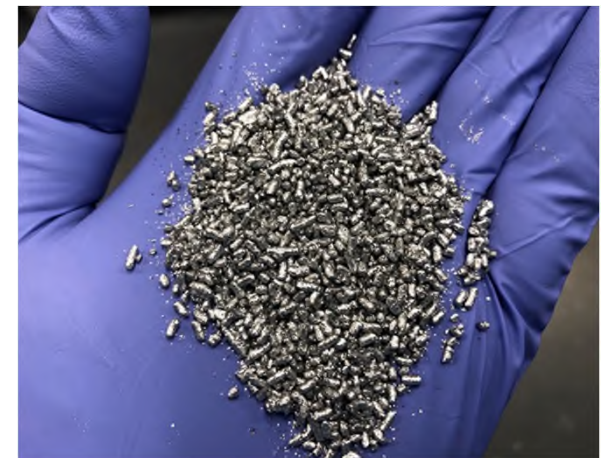
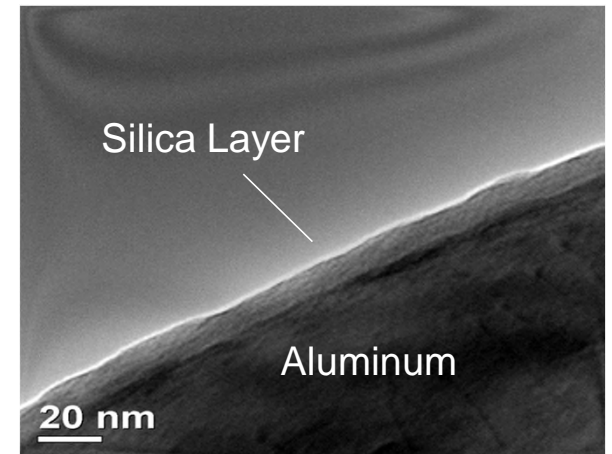


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AQ Granules – Features & Benefits

SILBERLINE

- Excellent capability in multiple solvents
 - Glycols
 - Alcohols
 - Acetates
 - Water
- Easy dispersion directly into resin – no pre-soak required
- Greater hiding power than silica treated paste at equal metal
- Gassing performance equivalent or better than silica treated paste
- Recyclable cardboard packaging with thick heat-sealed liner
- Accelerated weathering studies in progress (all good to date)
 - 4800hrs SAE J2527
 - AQ Paste Adhesion: 4B Pass
 - AQ Granule Adhesion: 4B Pass
 - ΔE at 6 Angles (-15° to 110°): < 2 units



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Questions? Thank You!