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# **Formulation Guidelines to Matting Hardener AHA2199 for Hybrid Powder Coatings**



## Description

**Composition :** Modified acid acrylics, wax/Al salt of stearate-free

**Application:** Dead matte pure epoxy and hybrids

**Chemistry:** AHA 2199, which has multi-different functional groups may react with epoxide, provides different curing rates to form intense matting effects.

### Advantages:

- Suitable to both pure epoxy and hybrids
- 60° gloss down approaching to 0%
- **May be used in place of traditional XX68**
- **Part of 70/30 polyester may act as co-reactant**
- Better anti-yellowing
- High film hardness & anti-scratch
- Relative low cost

### Affect factors:

The following factors to AHA2199 will determine the final coating gloss obtainable under realistic conditions:

- The amount of AHA2199 added
- The amount of polyester added

**Matting hardener AHA2199**

- The types of polyester (both 50/50 and 60/40 are possible to increase gloss, however 70/30 type can give very good result)
- The type and load of pigment & filler added (higher loads will decrease gloss but also has an adverse effect on impacts)
- Process condition (higher extrusion temperature increases gloss very sharply )
- Cure temperature

**Typical Physical Data**

<i>Appearance</i>	<i>[visual]</i>	<i>Pale yellow powder</i>
<i>Melting range (°C)</i>	<i>[instrument]</i>	<i>90-112</i>
<i>Combined weight</i>		
<i>with epoxy</i>	<i>[calc.]</i>	<i>1:4.0</i>
<i>Volatiles (%)</i>	<i>[2hrs baked at oven]</i>	<i>≤1.5</i>

*Typical properties and do not constitute specification limits.*

## Formulation guidelines

In recent years, the supply quantities/prices of traditional matting hardener XX68 (a monosalt of 2-phenyl imidazolin with pyromellitic acid) yields drastic fluctuation due to environmental and raw material shortage. Therefore it is very significant for trying to develop a new product capable replacing XX68.

Now we are pleased to announce that AHA has developed successfully a novel matting hardener AHA2199, in addition to suitable for pure epoxy system, it can also be used well in hybrids to provide dead matte finish of 60° gloss as low as 0%.

AHA2199 seems to have same value orientation with traditional matting hardener XX68 capable of good suitable any 70/30 hybrid system to provide better anti-yellowing, film performance and quite low cost.

For any polyester added into formulation AHA2199 does almost not have any selectivity, but its amount added must be limited within a proper range. This reasonable limitation was found to be less than 41 wt. % based on both binders (epoxy + polyester) when AHA2199 is maintained at minimum level, approx. 6 wt. % by total formulation. Furthermore, due to low polyester selectivity many high reactive polyester resins also are used in formulation for improving coating cure and impacts.

It has now observed that extrusion temperatures have an adverse effect very sharply on gloss reproducibility, therefore it is fatal how to precisely control to extrusion temperatures. Once a higher-than-expected gloss obtainable occurs in either laboratory or production, you should be considerable to reduce the temperature of the extruded coating as a solution. **For this reason, the use of extrusion temperature as low as possible in process is strongly recommended.**

As a starting point based on following formulation, if AHA2199 can work within use level range from 6 to 10 wt. % based on total formulation the outstanding technical performance may be achieved, such as impacts, surface flow and gloss reproducibility. As compared with XX68, you can refer to the control example (marked in red words) in table I.

## Matting hardener AHA2199

Table 1: Standard formulation (70/30 type)

Composition	Part by Weight			Remark
	White	Black	Control	
Polyester	240	240	140	70/30, AHA5700
E-12	344	344	460	Epoxy
AHA 1088P	10	10	10	Flow modifier
Barytes	150	350	150	
TiO <sub>2</sub>	200	/	200	
Carbon Black	/	6	/	
AHA 4100	6	6	6	Benzoin
AHA 2199	60	60	/	2199 to epoxy 1:4
XX68	/	/	40	XX68 to epoxy 1:10
<b>Total</b>	<b>1010</b>	<b>1016</b>	<b>1006</b>	
<b>Cure Cycle</b>	<b>200°C @15min</b>		<b>180°C @15min</b>	
<b>Typical technical data:</b>				
Use level (max.)	6%	6%	4%	
Gloss%,60°	4.4	2.6	20.6	
Film thickness	70µm	70µm	70µm	
Impacts (D&R):	+/-	+/-	+/-	
PCI level:	6	6	6	
Appearance:	Micro rough	Do(left)	Do	
<b>Color stability (70/30 only)</b>				
Color difference, ΔE	2.20	/	4.87	
Yellowing index, Δb	1.82	/	4.48	

## Matting hardener AHA2199

Table 2: Standard formulation

Composition	Part by Weight						Remark
	White	Black	White	Black	White	Black	
	240	240	/	/	/	/	70/30
Polyester	/	/	200	200	/	/	60/40
	/	/	/	/	170	170	50/50
E-12	344	344	380	380	410	410	Epoxy
AHA 1088P	10	10	10	10	10	10	Flow modifier
Barytes	150	350	150	350	150	350	
TiO2	200	/	200	/	200	/	
Carbon Black	/	6	/	6	/	6	
AHA 4100	6	6	6	6	6	6	Benzoin
AHA 2199	60	60	60	60	60	60	2199 to epoxy 1:4
<b>Total</b>	<b>1010</b>	<b>1016</b>	<b>1006</b>	<b>1012</b>	<b>1006</b>	<b>1012</b>	
<b>Cure Cycle</b>	<b>200°C @15min</b>						
<b>Typical technical data:</b>							
Use level (max.)	6%	6%	6%	6%	6%	6%	
Gloss%,60°	4.4	2.6	5.1	10	3.8	2.8	
Film thickness	70µm	70µm	60µm	80µm	70µm	90µm	
Impacts (D&R):	+/-	+/-	+/-	+/-	+/-	+/-	
PCI level:	6	6	6	6	6	6	
Appearance:	Micro rough						

## Key performance test

### *Color difference:*

Data acquisition for color difference and yellowing index from

For AHA2199

- 1) *Original baked at 200°C@15min (standard cure)*
- 2) *Overbaking at 220°C@20min*

For XX68

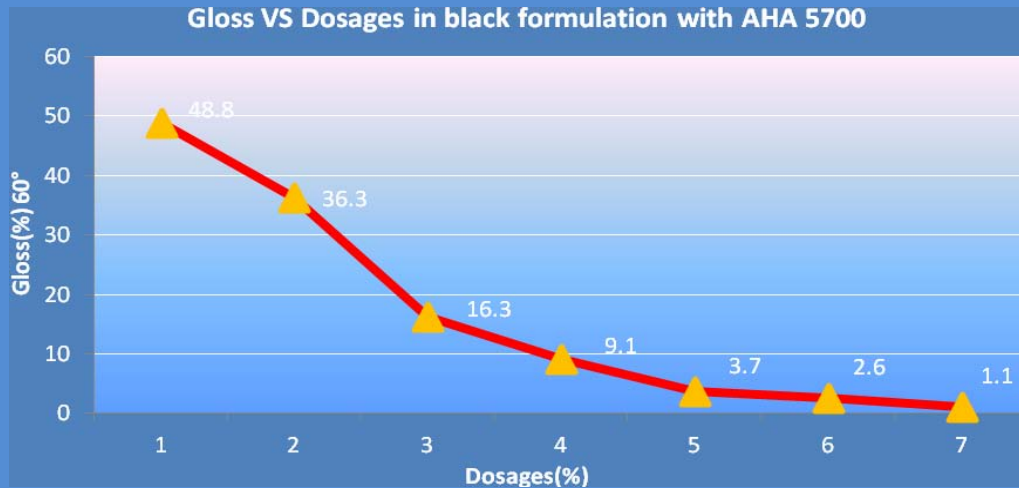
- 1) *Original baked at 180°C@ 15min (standard cure)*
- 2) *Overbaked at 210°C@ 20min*

Formula:  $\Delta E_{ab} = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$

*Surface flow:* PCI criterion (level)

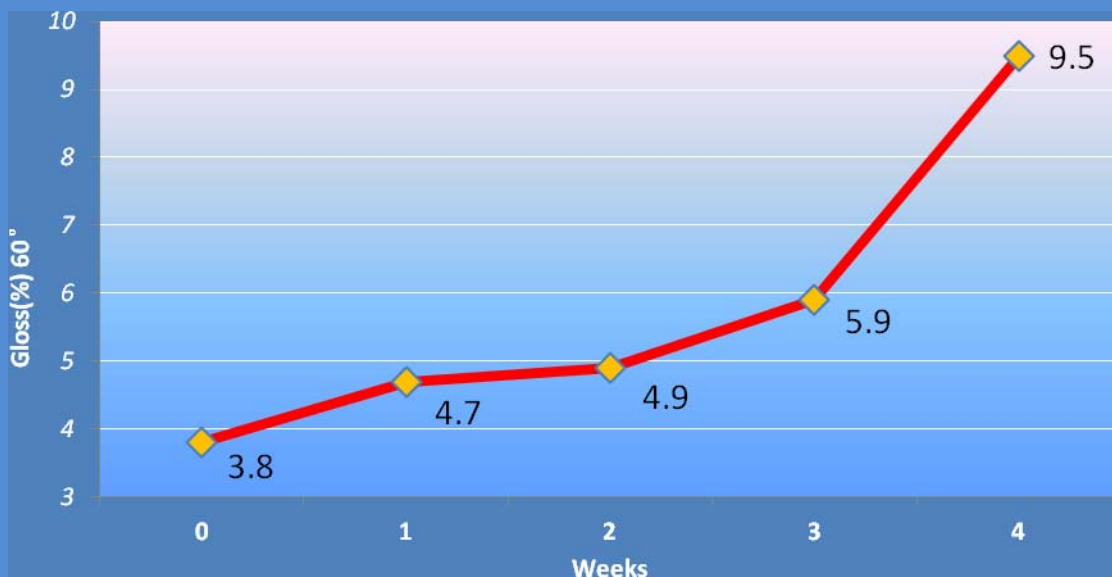
## Gloss vs Dosages

Matting effect by AHA2199 with 70/30 typical polyester AHA 5700



## Gloss storage stability (Black)

Storage stability under accelerated aging condition (40°C AHA 5700 Black)



## Conclusion

**Much more cost-saving & benefits !**

AHA2199 is a superior matting hardener capable of as replacement of traditional matting hardener XX68. This product is, esp. in conjunction with 70/30 typical polyester, used in hybrids capable of achieving dead matt effect with gloss as low as 0 unit and balance of the optimum performance with cost effective!



**Appendix:**

**Some formulation examples**

**Table 3: Standard formulation (70/30 type)**

Composition	Part by Weight		Remark	
	White	Black		
Polyester	120	120		
E-12	172	172	<i>Epoxy</i>	
AHA 1088P	5	5	<i>Flow modifier</i>	
Barytes	75	175		
TiO2	100	/		
Carbon Black	/	3		
AHA 4100	3	3	<i>Benzoin</i>	
AHA 2199	30	30		
<b>Total</b>	<b>505</b>	<b>508</b>		
Supplier	Code	Gloss%,60°	PCL Level	
<i>AHA,Anhui</i>	AHA 5700	4.4	2.6	6
<i>Shenjian, Anhui</i>	SJ6#B	2.8	3.4	6
<i>Sino-Franch</i>	P7030Me	2.5	3.0	6
<i>Meicheng, Yantai</i>	M1711	3.4	10.2	6
	M1713	2.8	8.3	6
<i>YinYang,Guangdong</i>	YE6900	2.4	1.3	6
<i>Khua,Zhejiang</i>	GH-1171	3.0	7.1	6
<i>Jiajie, Anhui</i>	P7013	2.7	2.6	6
<i>Zhengjie, Anhui</i>	ZJ7030	3.6	1.5	6

**Matting hardener AHA2199**

**Table 4: Standard formulation (60/40 type)**

Composition	Part by Weight		Remark	
	White	Black		
Polyester	100	100		
E-12	190	190	<i>Epoxy</i>	
AHA 1088P	5	5	<i>Flow modifier</i>	
Barytes	75	175		
TiO2	100	/		
Carbon Black	/	3		
AHA 4100	3	3	<i>Benzoin</i>	
AHA 2199	30	30		
<b>Total</b>	<b>503</b>	<b>506</b>		
Supplier	Code	Gloss%,60°	PCL Level	
<i>AHA,Anhui</i>	AHA 5600	10.0	5.1	6
<i>Huicai,AnHui</i>	HC-6402	15.4	10.7	6
<i>Shenjian, Anhui</i>	SJ5#A	6.8	11.9	6
<i>Meicheng, Yantai</i>	M1613	3.1	7.3	6
	GH-1165	3.3	6.0	6
<i>Khua,Zhejiang</i>	GH-1166	4.7	9.3	6
	GH-1169	18.4	23.7	6

**Table 5: Standard formulation (50/50 type)**

Composition	Part by Weight		Remark	
	White	Black		
Polyester	85	85		
E-12	205	205	<i>Epoxy</i>	
AHA 1088P	5	5	<i>Flow modifier</i>	
Barytes	75	175		
TiO2	100	/		
Carbon Black	/	3		
AHA 4100	3	3	<i>Benzoin</i>	
AHA 2199	30	30		
<b>Total</b>	<b>503</b>	<b>506</b>		
Supplier	Code	Gloss%,60°	PCL Level	
<i>AHA,Anhui</i>	AHA 5500	3.8	2.8	6
<i>Shenjian, Anhui</i>	SJ3#F	7.3	12.9	6
<i>Meicheng, Yantai</i>	M1511	11.3	10.2	5
<i>Khua,Zhejiang</i>	GH-1156	4.9	8.2	6

**Matting hardener AHA2199**

**Table 6: Standard formulation (Pure Epoxy)**

Composition	Part by Weight	Remark
	<b>Black</b>	
E-12	<b>240</b>	<i>Epoxy</i>
AHA 1088P	<b>5</b>	<i>Flow modifier</i>
Barytes	<b>175</b>	
Carbon Black	<b>3</b>	
AHA 4100	<b>3</b>	<i>Benzoin</i>
AHA 2199	<b>60</b>	
<b>Total</b>	<b>486</b>	
Gloss%,60°	<b>2.5</b>	
PCL Level	<b>5-6</b>	
Appearance	<b>Pick up dirt</b>	

**Cost Checking**

**Table 7: Cost of the AHA 2199 VS XX68**

Composition	Black		Unit Price *	Cost of AHA's	Cost of XX68
	A	B			
Polyester	240	<b>140</b>	US\$1.80	US\$0.43	US\$0.25
Epoxy	344	<b>460</b>	US\$3.00	US\$1.03	US\$1.38
Flow Modifier	10	<b>10</b>	US\$2.50	US\$0.03	US\$0.03
Barytes	350	<b>350</b>	US\$0.50	US\$0.18	US\$0.18
Carbon Black	6	<b>6</b>	US\$19.00	US\$0.11	US\$0.11
Benzoin	6	<b>6</b>	US\$4.50	US\$0.03	US\$0.03
AHA 2199	60	<b>/</b>	US\$6.30	US\$0.38	/
XX68	/	<b>40</b>	US\$10.00	/	US\$0.40
<b>Total</b>	<b>1016</b>	<b>1012</b>		<b>US\$2.18</b>	<b>US\$2.37</b>

\* Unit price based on the latest sales price in market on Mar. 2018