



# Patcham Additives for UPR Systems

Complete Package of various  
additives and their performance

# Contents

- UPR Industries
- Patcham Additives
  - Defoamers
  - Surface Modifiers
  - Rheology Modifiers
  - Wetting and Dispersing Agents
  - Colorless Accelerator

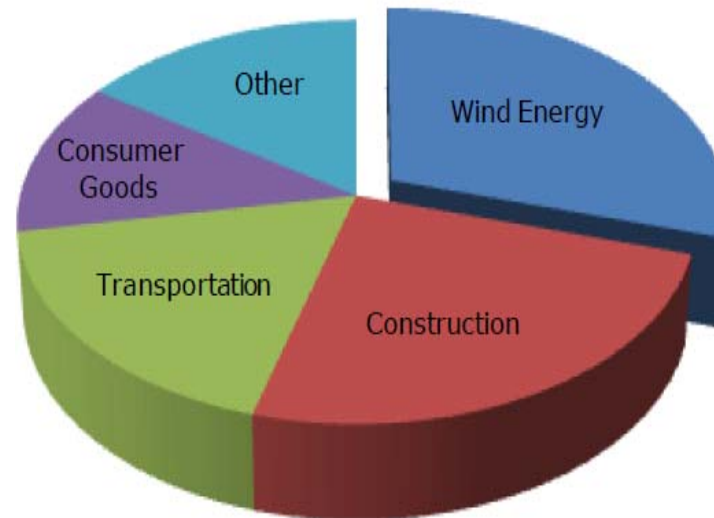
# UPR and Related Resin Industry

- Unsaturated Polyester Resin
- Reaction product saturated and unsaturated di-carboxylic acids with alcohols
- Cross-linked with a vinyl reactive monomer will form highly durable structures and coatings
- Utilized globally for the manufacture of products such as:
  - Sanitary ware pipes, Tanks, Gratings, Marine, Automotive industry, Building and construction

# Current Market Trend

By end use

- Wind Energy
- Construction
- Transportation
- Consumer Goods
- Others (Automotive, Marine, Gel coats etc.,)



# Application area

- Pigment Dispersions
- Gel Coats
- SMCs
- BMCs
- Pultrusions
- Clear Top Coats
- Hand Lay ups
- Spray applications



# Patcham Additives

Defoamers	Leveling Additive	Rheology Modifier
<b>Pat-Add AF 75</b> <b>Pat-Add AF 76</b>	<b>Pat-Add LE 1065</b>	<b>Pat-Add Rheol 253</b>

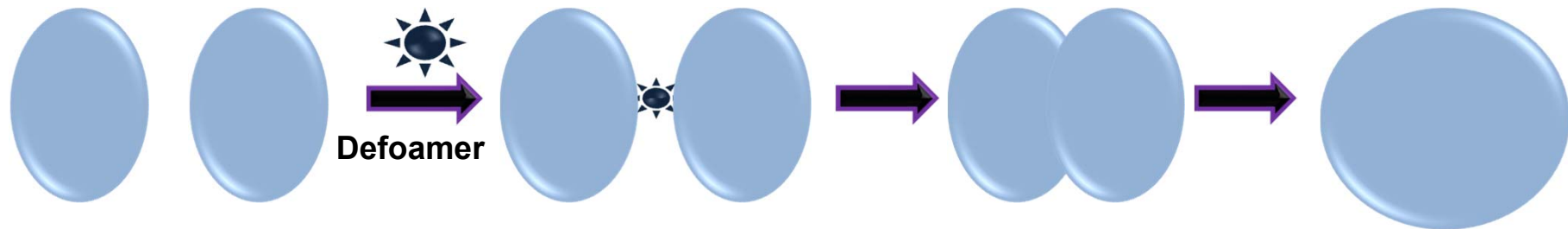
Dispersing Agents
<b>Pat-Add DA 2047 (for colorants)</b> <b>Pat-Add DA 2702</b> <b>Pat-Add DA 2709</b>

Colorless Accelerator
<b>Patcure 2716</b>

# Defoamers

- Defoamer should have limited solubility (incompatibility) in the system.
- No side effects such as crater formation.
- Lower surface tension
- Works through direct destruction of macro foam at the air interface and by avoiding major air entrapment

## Coalescence of micro bubbles



- Deaerators (non polar) are oriented in such a way to surround the air bubbles
- Deaerator migrates to the surface of air bubbles due to limited compatibility to the binder
- At this moment coalescence takes place and leads to the formation of bigger bubbles

*Stoke's law – Bigger air bubbles move with higher velocity than small bubbles.*



# Pat-Add AF 75

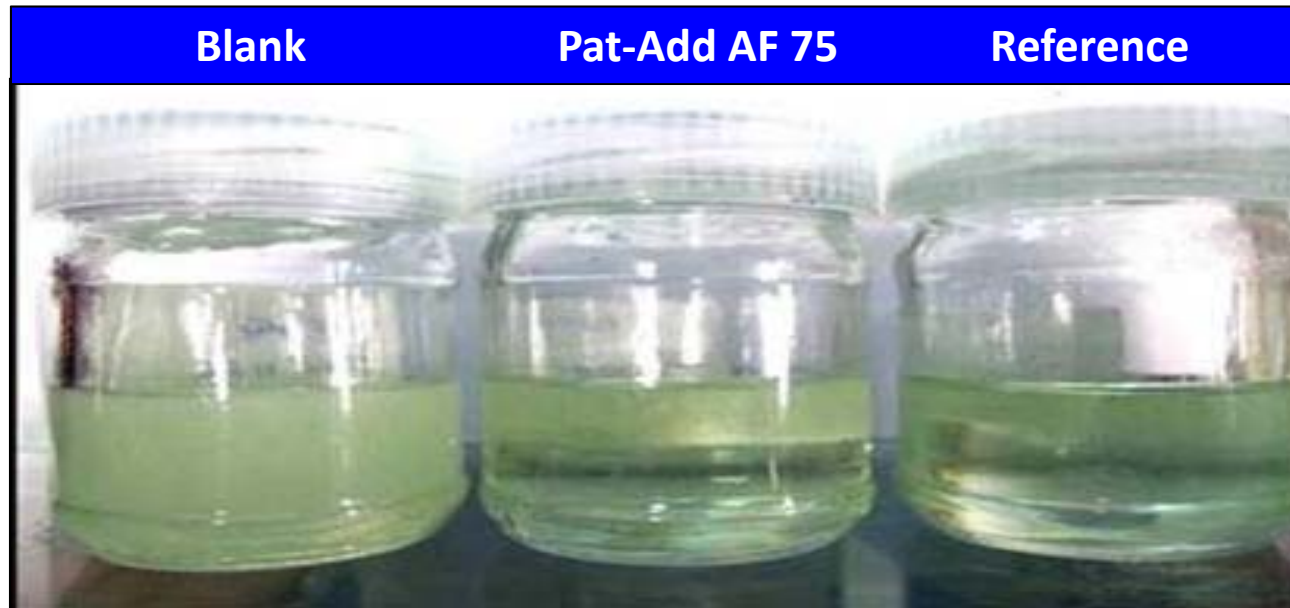
- A silicone free, polymeric de-aerator and defoamer
- Recommended for use in UPR systems and gel coats
- Demonstrates fast de-airing and is efficient in a wide range of systems at low dosages

# Pat-Add AF 75

Performance test in Iso-UPR against Reference 1

Test Formula			
Raw Materials	Blank	Pat-Add AF 75	Reference 1
UPR	100.00	100.00	100.00
Patcure 2716 (Cobalt Accelerator)	1.50	1.50	1.50
<b>Defoamer</b>	--	<b>0.15</b>	<b>0.15</b>
Hardener (MEKP)	2.00	2.00	2.00
<b>Total</b>	<b>103.50</b>	<b>103.65</b>	<b>103.65</b>

# Pat-Add AF 75

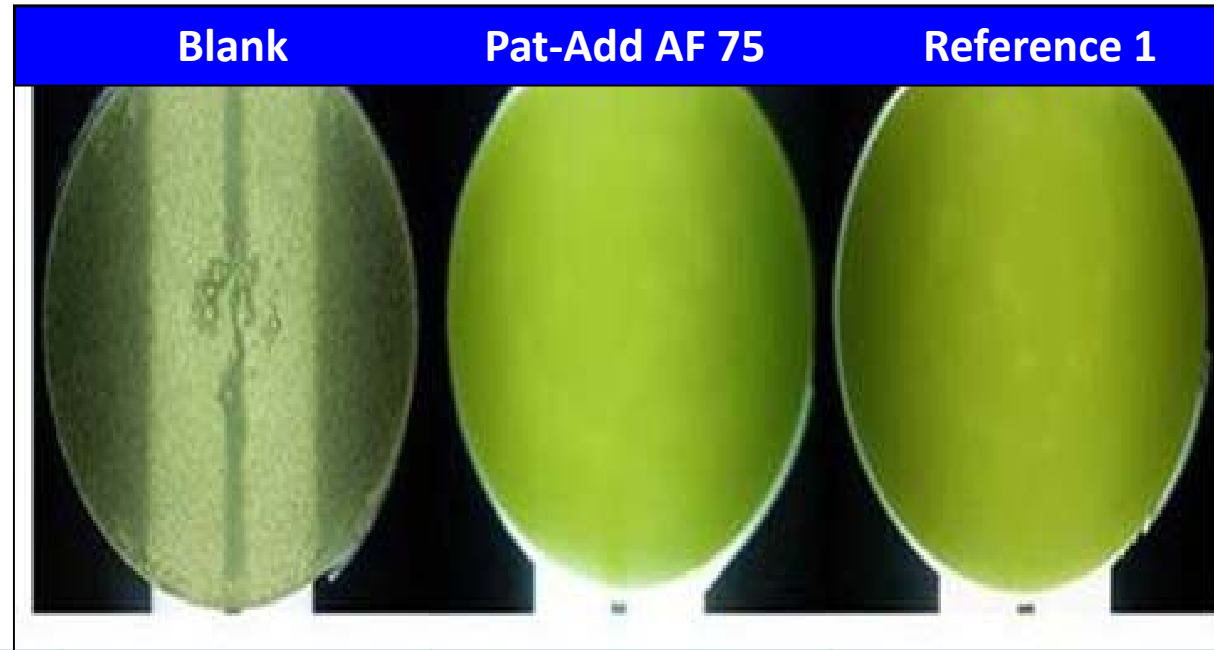


Properties	Blank	Pat-Add AF 75	Reference
Appearance	Hazy*	Clear	Clear
Rate of Defoaming	3	1	1

- \*Hazy because of the presence of foams
- Rating : 1 – fast, 3 - slow

# Pat-Add AF 75

Performance in Iso-UPR against Reference 1

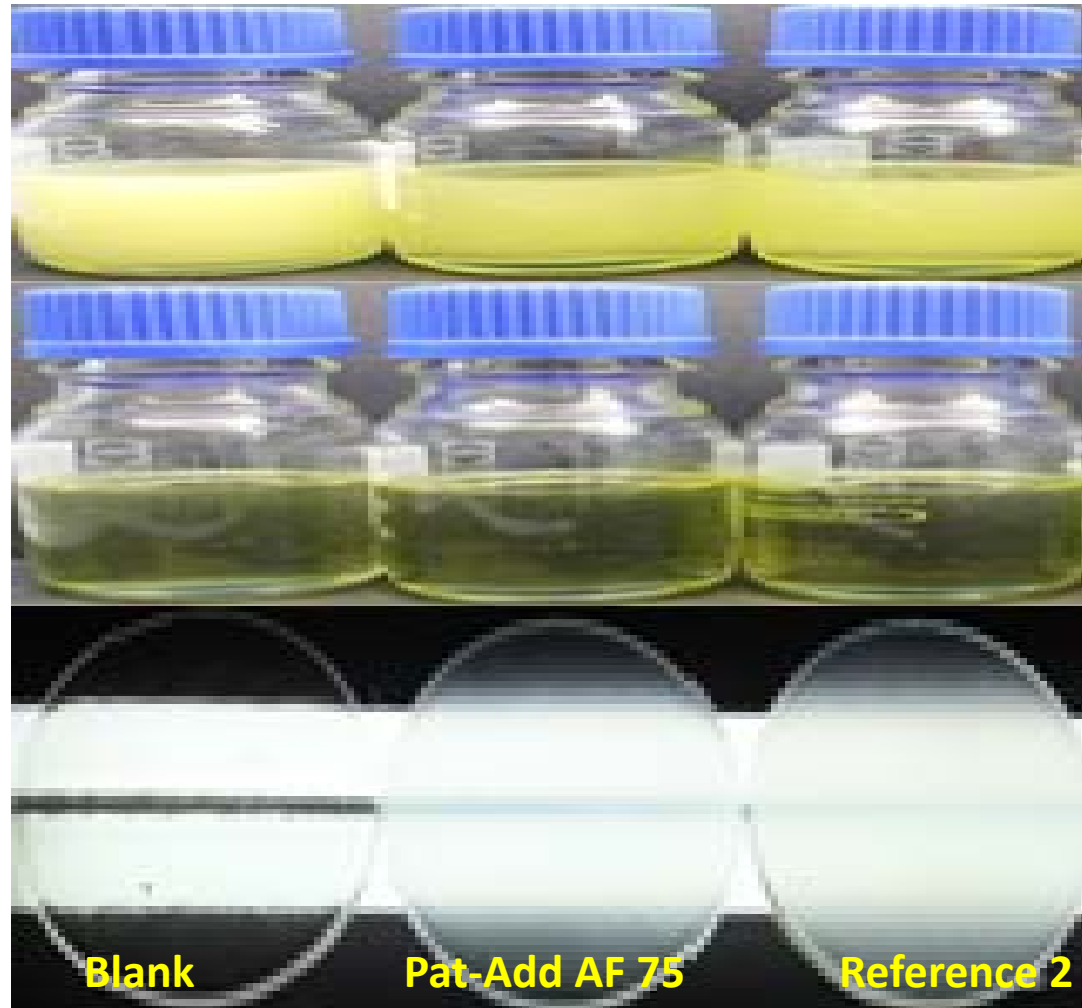


Appearance after curing (from molded panels)	Entrapped micro foam	No foam	No foam
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- Pat-Add AF 75 is suitable for avoiding air entrapment in ambient curing systems

# Pat-Add AF 75

Performance test in Iso-UPR against Reference 2



# Pat-Add AF 75

Performance test in Iso-UPR against Reference 2

<b>Properties</b>	<b>Blank</b>	<b>Pat-Add AF 75</b>	<b>Reference 2</b>
Appearance of Solution	Clear	Clear	Slight hazy
Rate of Defoaming	3	1	2
Appearance after curing (from moulded panels)	Entrapped micro foam	Slightly hazy	Hazy

# Pat-Add AF 76

- Silicone-free, polymeric de-aerator and defoamer for use in UPR systems, as well as in PUR and epoxy systems.
- Demonstrates fast de-airing and is efficient in a wide range of systems at low dosages
- Especially recommended for clear, transparent systems.

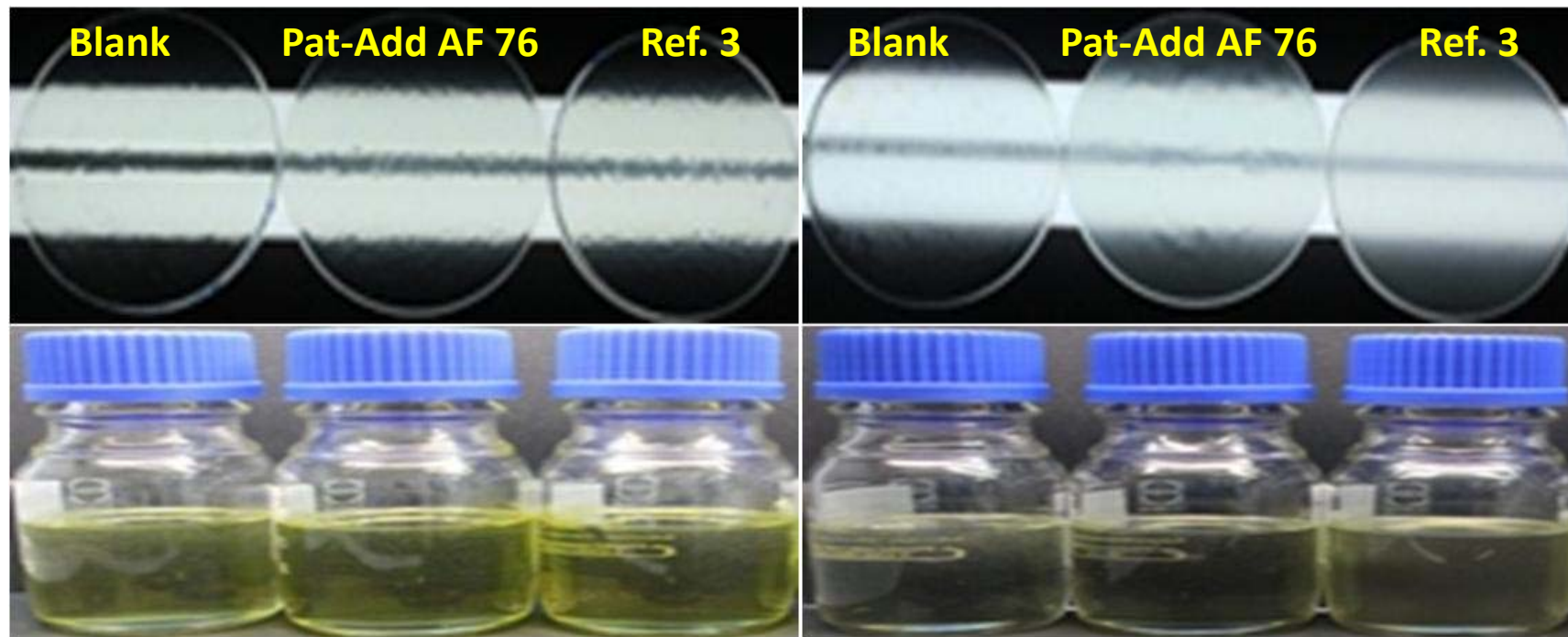
# Benefits of Pat-Add AF 76

- Highly recommended for clear laminates
- Produces good appearance
- Maintains and does not alter film properties of laminates or composites



# Pat-Add AF 76

Performance test in UPR Clear Laminates against Reference 3



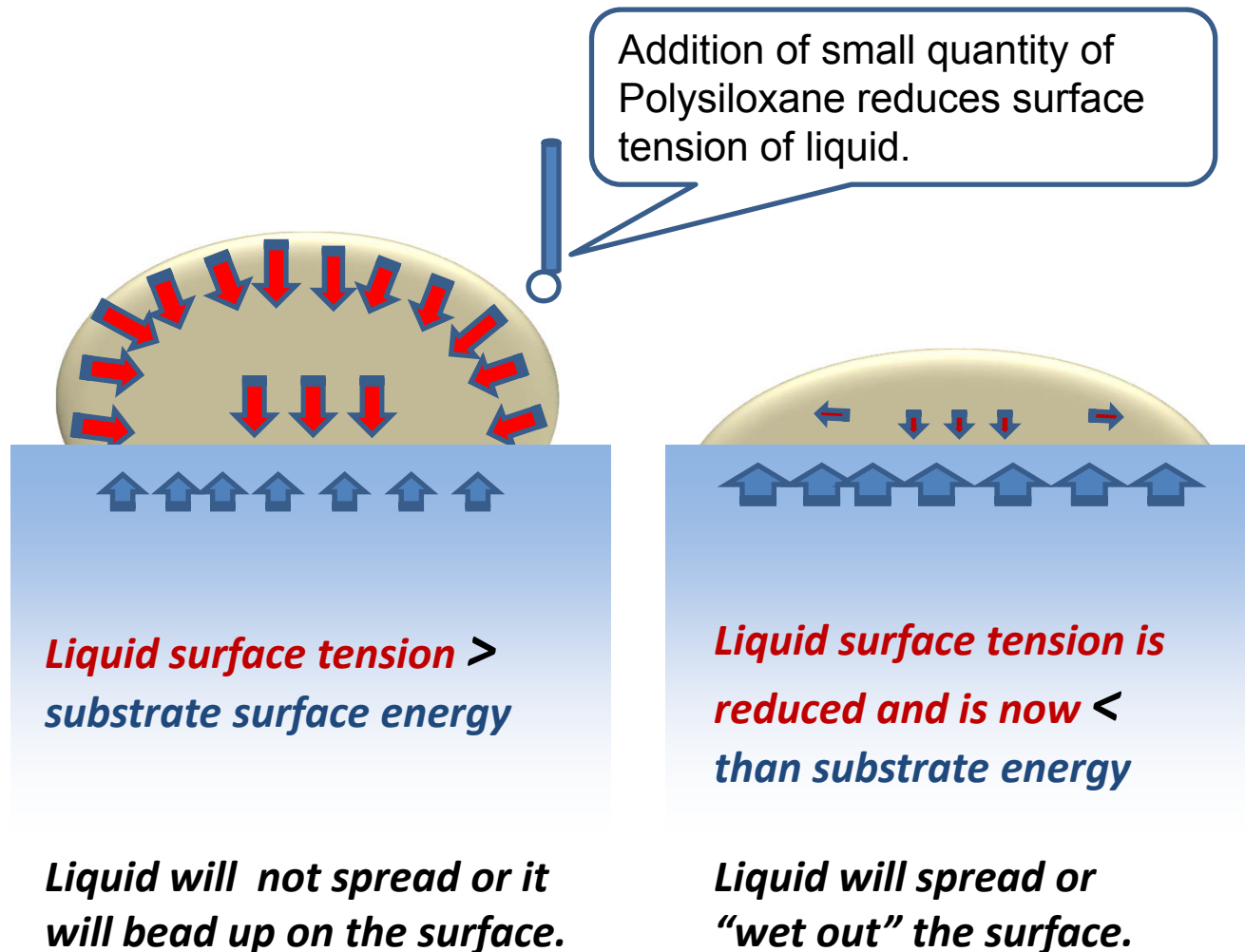
Isophthalic UPR System

Orthophthalic UPR System

# Pat-Add LE 1065

- Efficient surface tension modifier, effective at very low concentrations
- Promotes film leveling and avoids formation of craters
- Provides excellent surface smoothness, slip and mar resistance
- Counteracts pigment floating
- Suitable for use in pigmented as well as clear coating systems

# Pat-Add LE 1065 - Surface tension reduction



# Formulation of white topcoat

Raw Materials	% Wt
Ortho UPR	100.00
Titanium dioxide	15.00
Patcure 2716	0.25
<b>Pat-Add LE 1065 / Reference 4</b>	<b>0.60</b>

# Pat-Add LE 1065 in white top coat



# Surface properties

Parameters	Pat-Add LE 1065	Reference 4
<b>Initial</b>		
Gloss @ 20 <sup>0</sup>	94	84
Gloss @ 60 <sup>0</sup>	99	98
<b>After stability</b>		
Gloss @ 20 <sup>0</sup>	86	44
Gloss @ 60 <sup>0</sup>	94	87
<b>Craters rating</b>	0	5

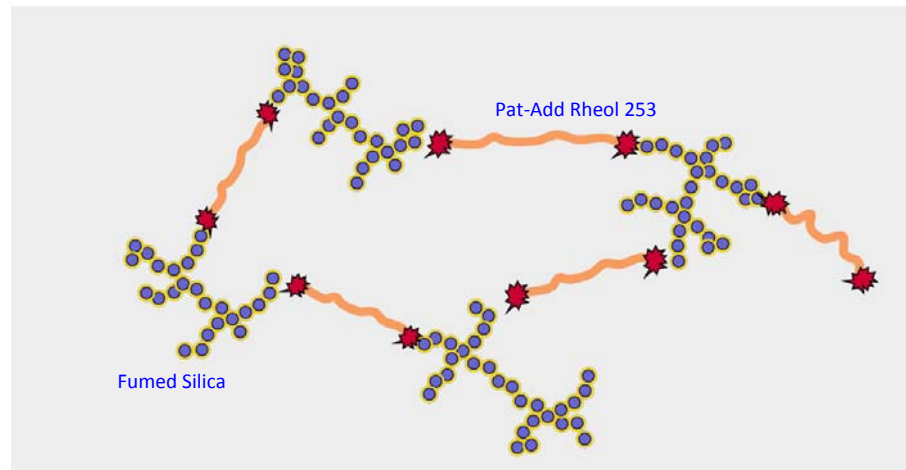
0 – Less crater, 5 – More crater

# Pat-Add Rheol 253

- A liquid rheology modifier for use in UPR systems, gel coats
- Contributes to the formation of a thixotropic structure and reduces risk of separation & settling
- Demonstrates excellent compatibility with a wide variety of systems
- Does not require any chemical activation

# Pat-Add Rheol 253

- Pat-Add Rheol 253 boosts the three dimensional structure
- Improves thixotropy and allows reduced loading of clays and fumed silica



Three dimensional network boost by Pat-Add Rheol 253

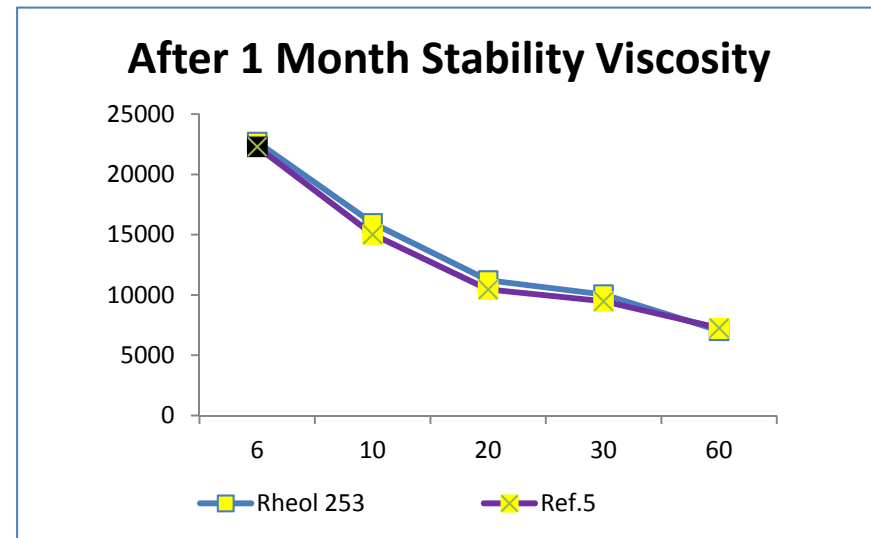
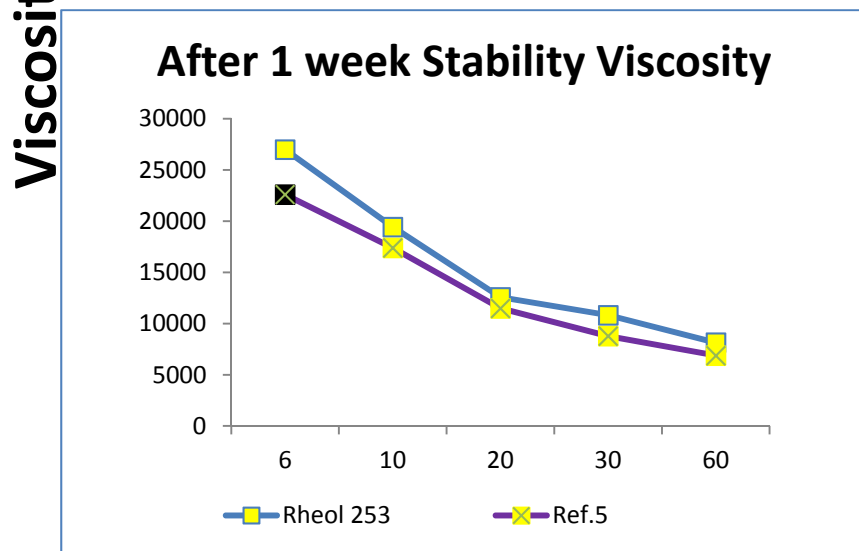
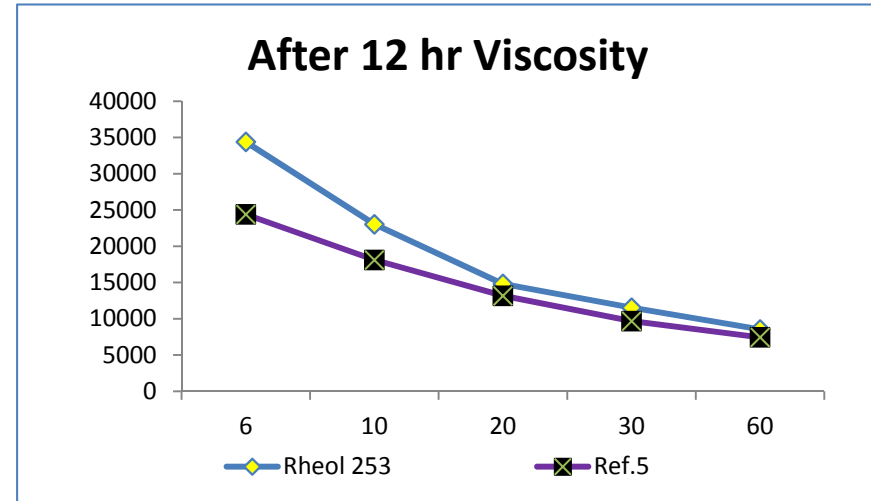
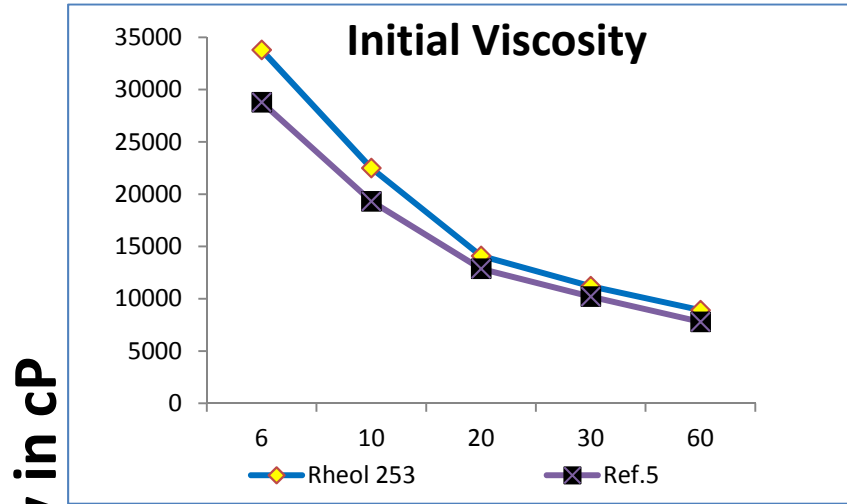
Fumed silica and clay based additives give pseudo plastic and thixotropic flow behavior



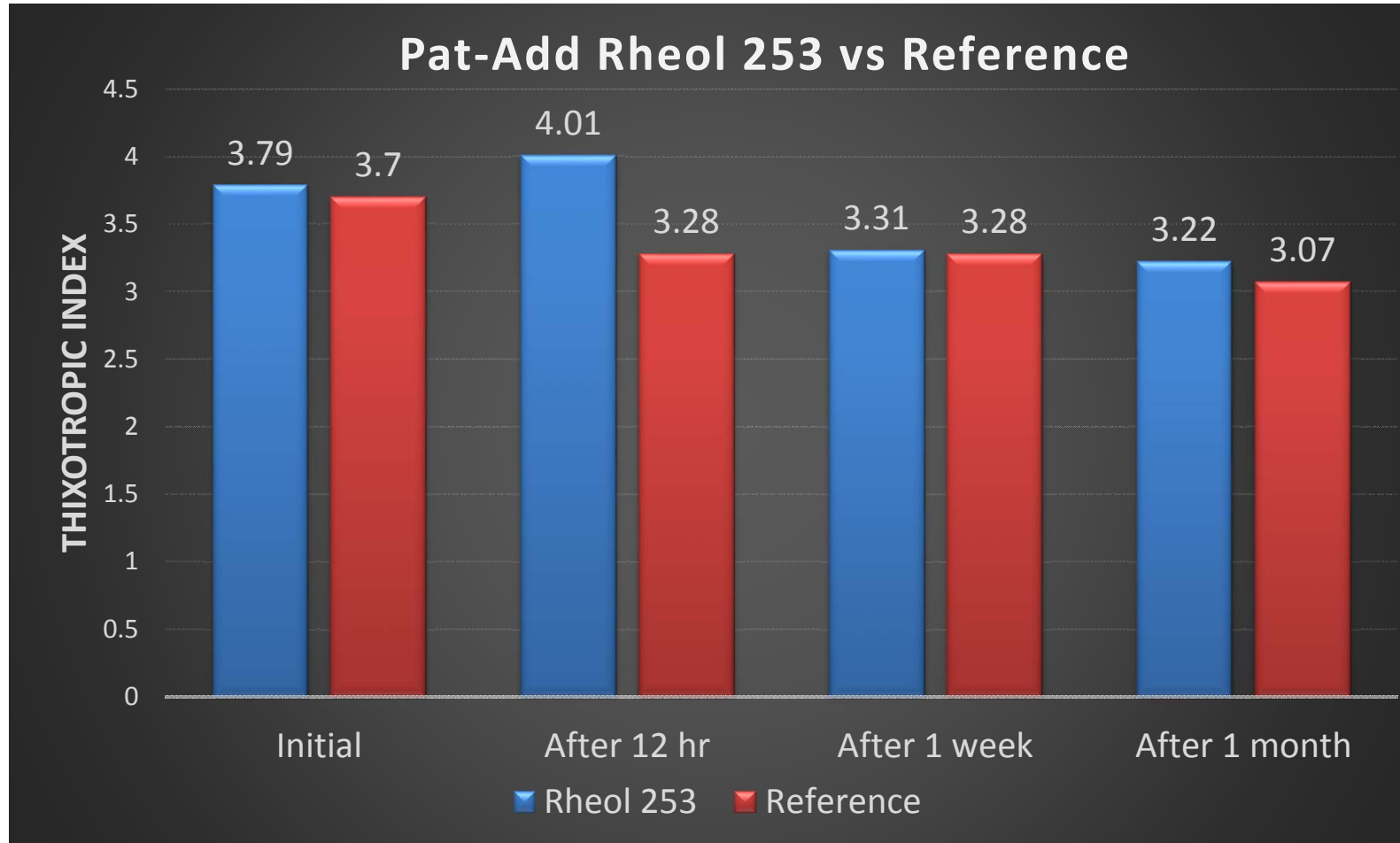
# Performance of Pat-Add Rheol 253

Raw Materials	Rheol 253	Reference 5
UP Resin	86.72	86.72
<b>Pat-Add Rheol 253</b>	<b>0.13</b>	-
Reference 5	-	0.13
<b>Pat-Add AF 75</b>	<b>0.5</b>	-
Reference 1	-	0.5
<b>Pat-Add LE 1065</b>	<b>0.3</b>	-
Reference 4	-	0.3
Pigment R 902	7.8	7.8
Aerosil 200	2	2
Cobalt 1%, accelerator	2.55	2.55
<b>Total</b>	<b>100.00</b>	<b>100.00</b>

# Performance of Pat-Add Rheol 253



# Thixotropic index



# Dispersing Additives for UPR Systems

# Pat-Add DA 2047

- Strong adsorption properties unto a wide variety of pigment surfaces
- Excellent dispersion stability
- Low viscosity for highly loaded pigment dispersions
- High transparency through optimum dispersion of fine particle sized pigments

# Pat-Add DA 2047 - Formulation

Raw Materials	PW 6		SP.Black 4		PB 15:3	
Mill base	Pat-Add DA 2047	Ref 6	Pat-Add DA 2047	Ref 6	Pat-Add DA 2047	Ref 6
Saturated Polyester	33.00	33.00	25.00	25.00	48.00	48.00
<b>Dispersing agent</b>	<b>5.00</b>	<b>5.00</b>	<b>15.00</b>	<b>15.00</b>	<b>14.00</b>	<b>14.00</b>
Pigment	60.00	60.00	15.00	15.00	14.00	14.00
<b>Letdown</b>						
Saturated Polyester	2.00	2.00	45.00	45.00	24.00	24.00
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>%SOP</b>	2.50	2.50	30.00	30.00	30.00	30.00

# Pat-Add DA 2047 - Properties

Properties	PW 6		SP.Black 4		PB 15:3	
	Pat-Add DA 2047	Ref 6	Pat-Add DA 2047	Ref 6	Pat-Add DA 2047	Ref 6
<b>Final viscosity of PC (cP)</b>	950	930	1754	2289	1243	1236
<b>Grinding time</b>	1 hr	1 hr	1 hr 30 min	1 hr 30 min	2 hr	2 hr
<b>RPM</b>	4000	4000	5000	5000	5000	5000

# Pat-Add DA 2047 in Colorants

## Color Measurement

Opacity (Mass tone)	PW 6		SP.Black 4		PB 15:3	
	Pat-Add DA 2047	Ref.6	Pat-Add DA 2047	Ref. 6	Pat-Add DA 2047	Ref. 6
<b>Mass tone</b>						
L*	96.86	96.47	2.09	2.88	33.32	29.86
a*	-0.22	-0.06	0.07	-0.05	-39.36	-35.56
b*	2.98	3.12	-0.26	-0.29	-29.06	-29.06
<b>Tinting strength (10% reduction in UPR base resin)</b>						
L*	NA	NA	54.28	51.28	67.51	68.19
a*	NA	NA	-0.88	-0.60	-20.45	-20.15
b*	NA	NA	-2.49	-1.59	-29.83	-28.91



# Pat-Add DA 2047 in Colorants

White TR 902

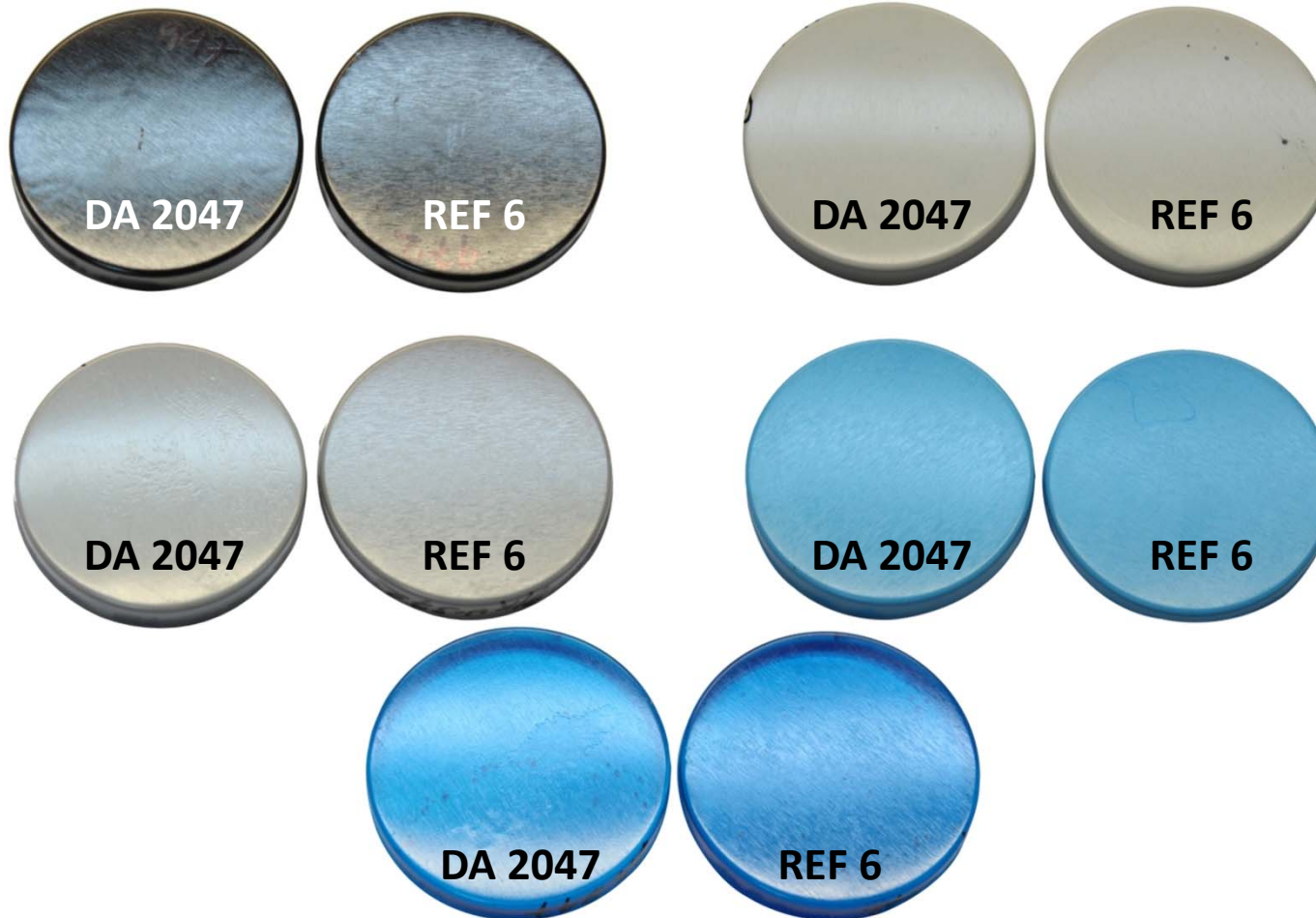
Special Black 4

Phthalo Blue 15:3



# Pat-Add DA 2047 in Colorants

Actual cured samples



# Pat-Add DA 2702

- Wetting and dispersing additive for dispersion of commonly used fillers such as calcium carbonate and aluminum trihydroxide (ATH)
- Reduces compound viscosity so a higher filler loading is possible

# Pat-Add DA 2702

Raw Material	Pat-Add DA 2702	Reference 7
<b>Ortho UPR system</b>		
Ortho UPR	59.75	59.75
<b>Dispersant</b>	<b>0.25</b>	<b>0.25</b>
CaCO <sub>3</sub>	40.00	40.00
<b>Total</b>	<b>100.00</b>	<b>100.00</b>
<b>ISO UPR system</b>		
ISO UPR	59.75	59.75
<b>Dispersant</b>	<b>0.25</b>	<b>0.25</b>
CaCO <sub>3</sub>	40.00	40.00
<b>Total</b>	<b>100.00</b>	<b>100.00</b>

# Pat-Add DA 2702

Properties	Pat-Add DA 2702		Reference 7	
	Ortho UPR	ISO UPR	Ortho UPR	ISO UPR
<b>Initial Viscosity In Krebs</b>	118.1	106.4	114	121
<b>After 24 hrs Viscosity in Krebs</b>	117.7	102.3	117.7	122.6
<b>Degree of separation</b>	No Separation		No Separation	

# Pat-Add DA 2702 - Anti Settling Properties

## ISO phthalic UPR System



## Ortho phthalic UPR System



# Pat-Add DA 2709

- Green, Wetting and Dispersing agent for high filler loading systems
- Reduces the viscosity of polyester casting resin
- Effective for ATH and other fillers
- Improves the flow and leveling behavior of resin mixture
- Does not affect drying characteristics

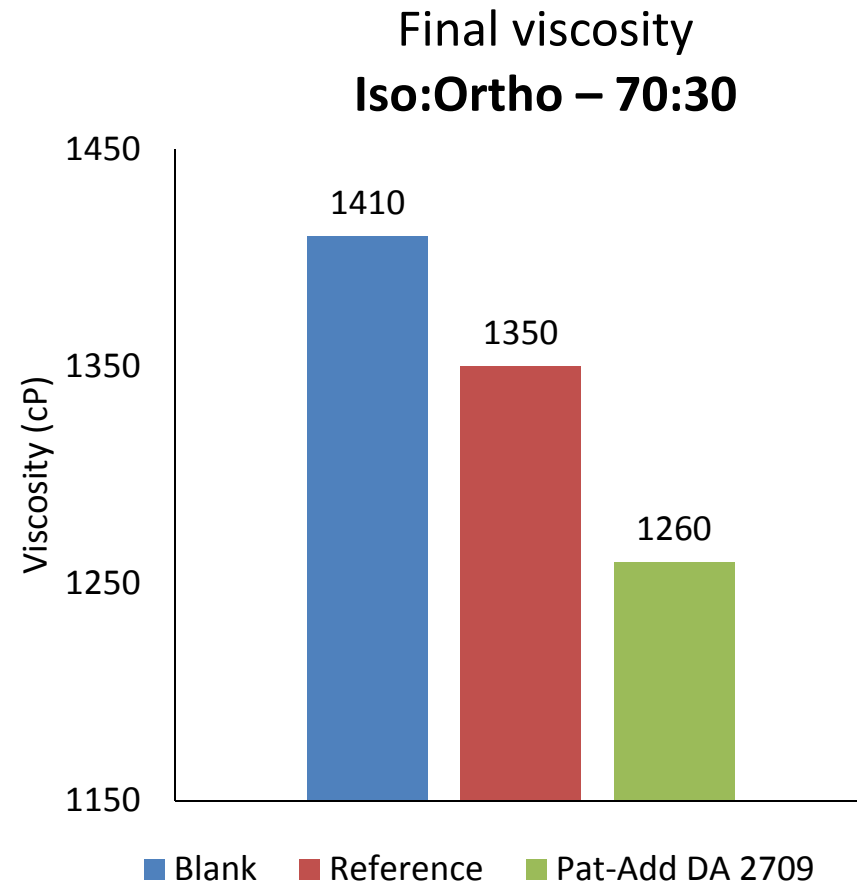
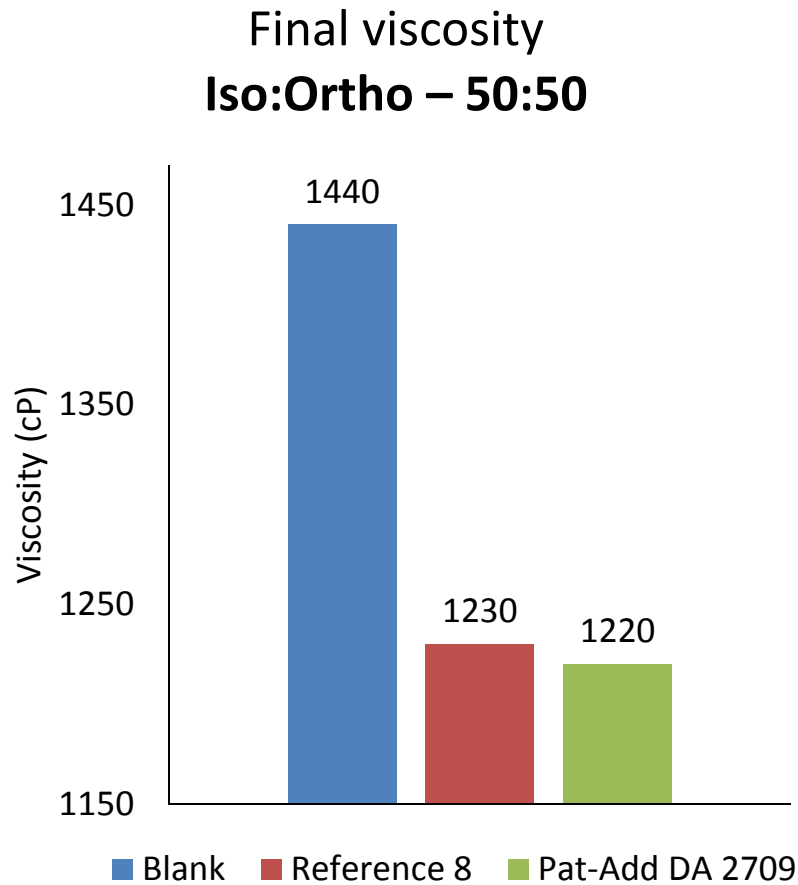
# Formulation – Low PHR loading of ATH

Raw material	ISO : Ortho 50 : 50	ISO : Ortho 70 : 30
	%wt	%wt
ISO UPR	50.00	70.00
Ortho UPR	50.00	30.00
<b>Pat-Add DA 2709 / Reference 8</b>	<b>0.60</b>	<b>0.60</b>
ATH* (13-15 $\mu\text{m}$ )	60.00	60.00
Total	160.60	160.60

\* ATH – Aluminum trihydroxide



# Final Viscosity – Low PHR of ATH



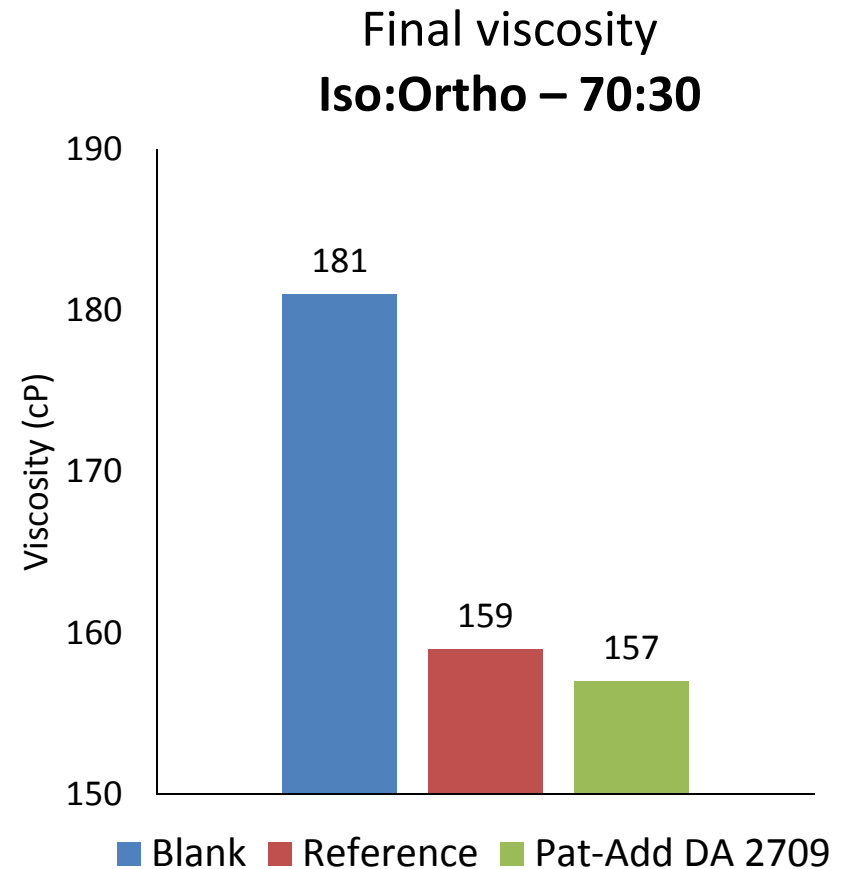
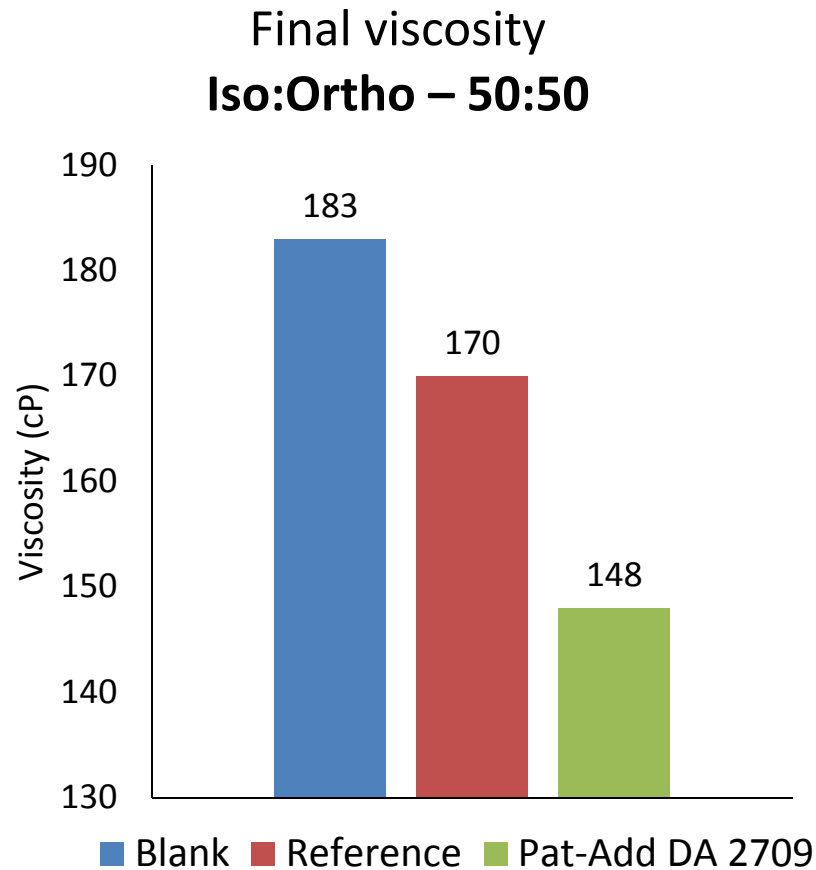
Viscosity is measured by Brook field viscometer (DV 2+) using Spindle No.4 at 20 RPM

## Formulation – High PHR loading of ATH

Raw material	ISO : Ortho 50 : 50	ISO : Ortho 70 : 30
	%wt	%wt
ISO UPR	50.00	70.00
Ortho UPR	50.00	30.00
<b>Pat-Add DA 2709 / Reference</b>	<b>1.00</b>	<b>1.00</b>
ATH* (13-15 $\mu\text{m}$ )	160.00	160.00
Total	261.00	261.00

\* ATH – Aluminum trihydroxide

# Final Viscosity – High PHR of ATH



Viscosity by CAP 2000+ (Cone and Plate Viscometer) using spindle No.3 at 20 RPM

# Observation

- Enables high loading of ATH in UPR system
- Reduces the viscosity of the resin mixture by providing excellent wetting
- Enhances the flow behavior and leveling

# Patcure 2716 and Cobalt Octoate 6%

Properties	Patcure 2716	COBALT OCTOATE 6%
Standard Gel Time (18 – 28 minutes)	23 minutes	22 minutes
Appearance of Casting	Colorless and Clear	Purple and Clear

\* Typical formulation: Resin 100 g, Accelerator 0.25 g, MEKP 1.5 g



# Gel Time Drift Study of Patcure 2716

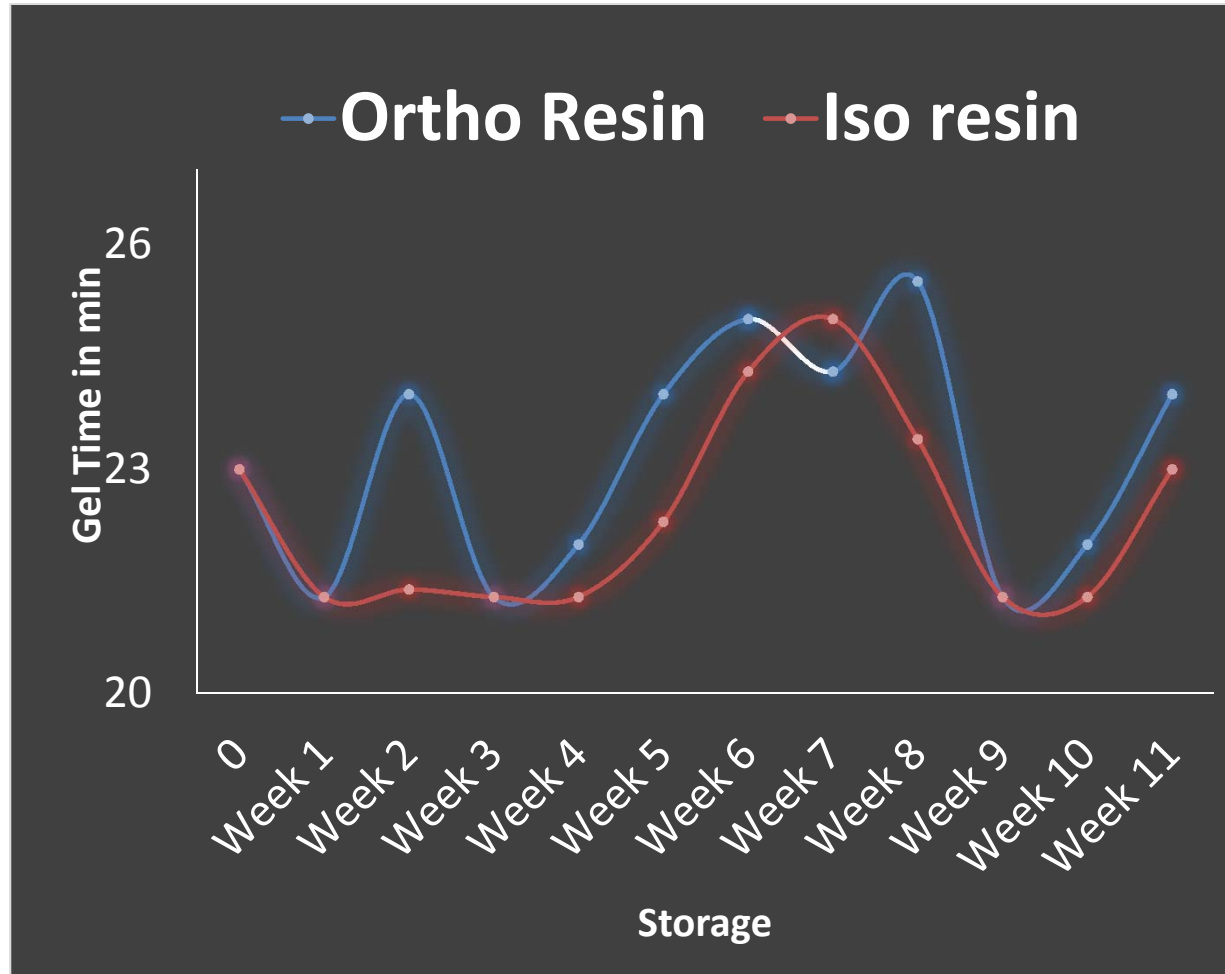
## Testing Formulation

Raw material	Ortho Phthalic Resin * (g)	Isophthalic Resin * (g)
UPR Resin	100.0	100.0
<b>Patcure 2716</b>	<b>0.25</b>	<b>0.25</b>
MEKP	1.50	1.50

\*Ortho Phthalic resin (Polypol 1001) and Iso phthalic resin (Polypol 1023) from Polychem Resins international industries LLC,Dubai.

# Gel Time Drift

Testing done at room temperature (22°C - 27°C)



Duration	Gel time (min)	
	Ortho	Iso
Start	23	23
Week 1	21.3	21.3
Week 2	24	21.4
Week 3	21.3	21.3
Week 4	22	21.3
Week 5	24	22.3
Week 6	25	24.3
Week 7	24.3	25
Week 8	25.5	23.4
Week 9	21.3	21.3
Week 10	22	21.3
Week 11	24	23

# THANK YOU

**Disclaimer:**

While every effort is made to provide accurate and complete test results for The PATCHAM ADDITIVES, various data may vary depending upon different raw materials, test procedures and test conditions. The accuracy, reliability, or totality of the results are not guaranteed or warranted in any way. PATCHAM FZC and its representatives disclaim liability of any kind whatsoever, including liability for quality, performance and fitness for a particular purpose arising out of the use, or inability to use the test results.