

The Use of UV Stabilizers in Aliphatic Polyurea Coatings

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Statement of Problem

End-users are willing to pay a premium for aliphatic, light-stable coatings, but they also expect premium performance.

In some cases, however, the non-yellowing aliphatic coatings lose mechanical performance (crack formation) over time in exposure to light.

Solution

Crack resistance in these aliphatic coatings can be increased up to 30-fold by selecting the right UV stabilizer.

Weatherometer Testing

- * Atlas Ci65A Xenon Lamp Weatherometer
- * ASTM Method G 26
- * Black panel temperature was 63°C
- * Treatment Cycle:
 1. 102 minutes of light
 2. 18 minutes of light and water spray

Color - Yellow Index

- * ACS PEF-C04 Dual Channel Spectrometer
- * A standard white backup tile had a YI of 8.7
- * Two readings were taken for each sample

Crack Resistance

- * Determined visually

General Formulation for the Aliphatic Polyurea Coatings

A-Side	Desmodur I (%)	45.8
	JEFFAMINE D-2000 (%)	54.2
	% NCO	15.0
	Index	105
B-Side	JEFFAMINE D-2000 (%)	48.0
	Clearlink 1000 (%)	52.0
	Stabilizer (%)	1.60
Processing	Volume Ratio (A/B)	1.00
	Cartridge Temperature (C)	23

Typical Physical Properties for the Aliphatic Polyurea Coatings

Coating Thickness (mil)	30
Pot Life (sec)	~15
Tack-free Time (min)	9
Hardness, inst. (Shore D)	55
Tensile Strength (psi)	3540
100% Modulus (psi)	1750
Elongation (%)	490
Tear Resistance (pli)	630
Tear Prop. Resist. (pli)	540
Resilience (%)	42

Photograph of the Aliphatic Test Specimens

Ali None

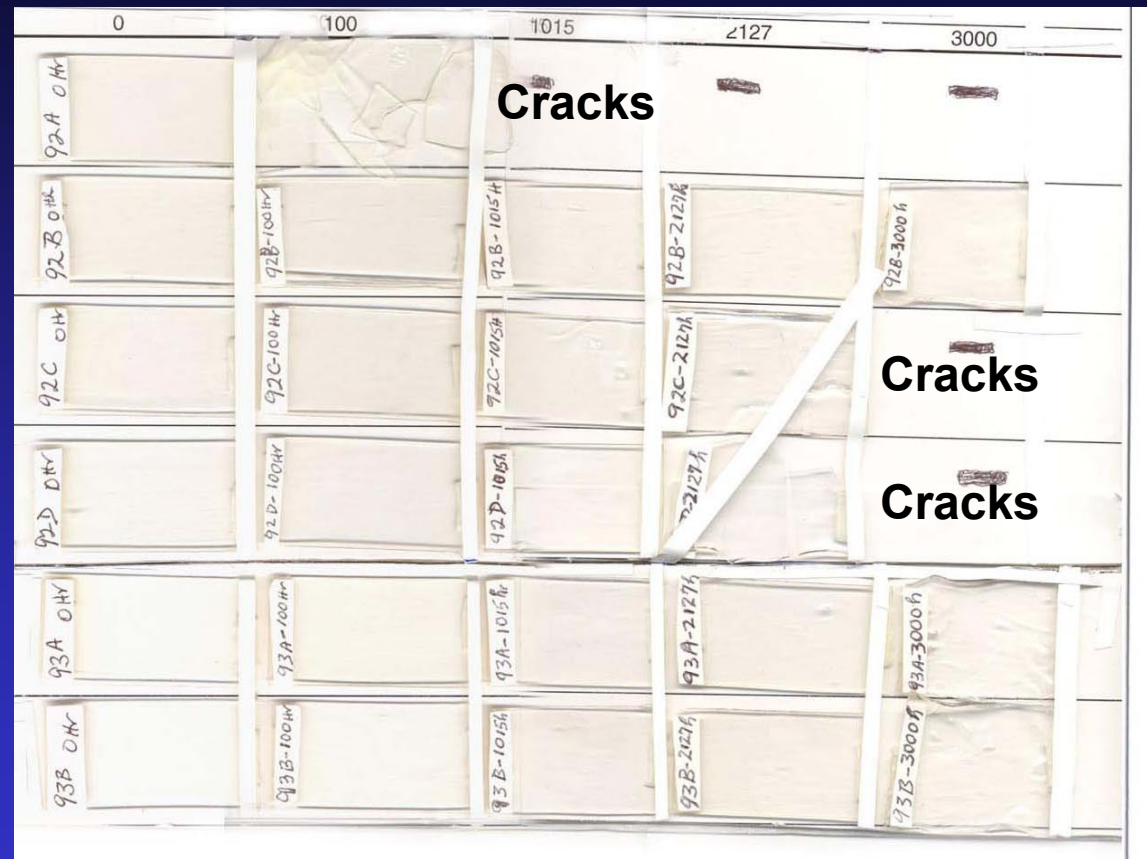
Ali A

Ali B

Ali C

Ali E

Ali F



0 h

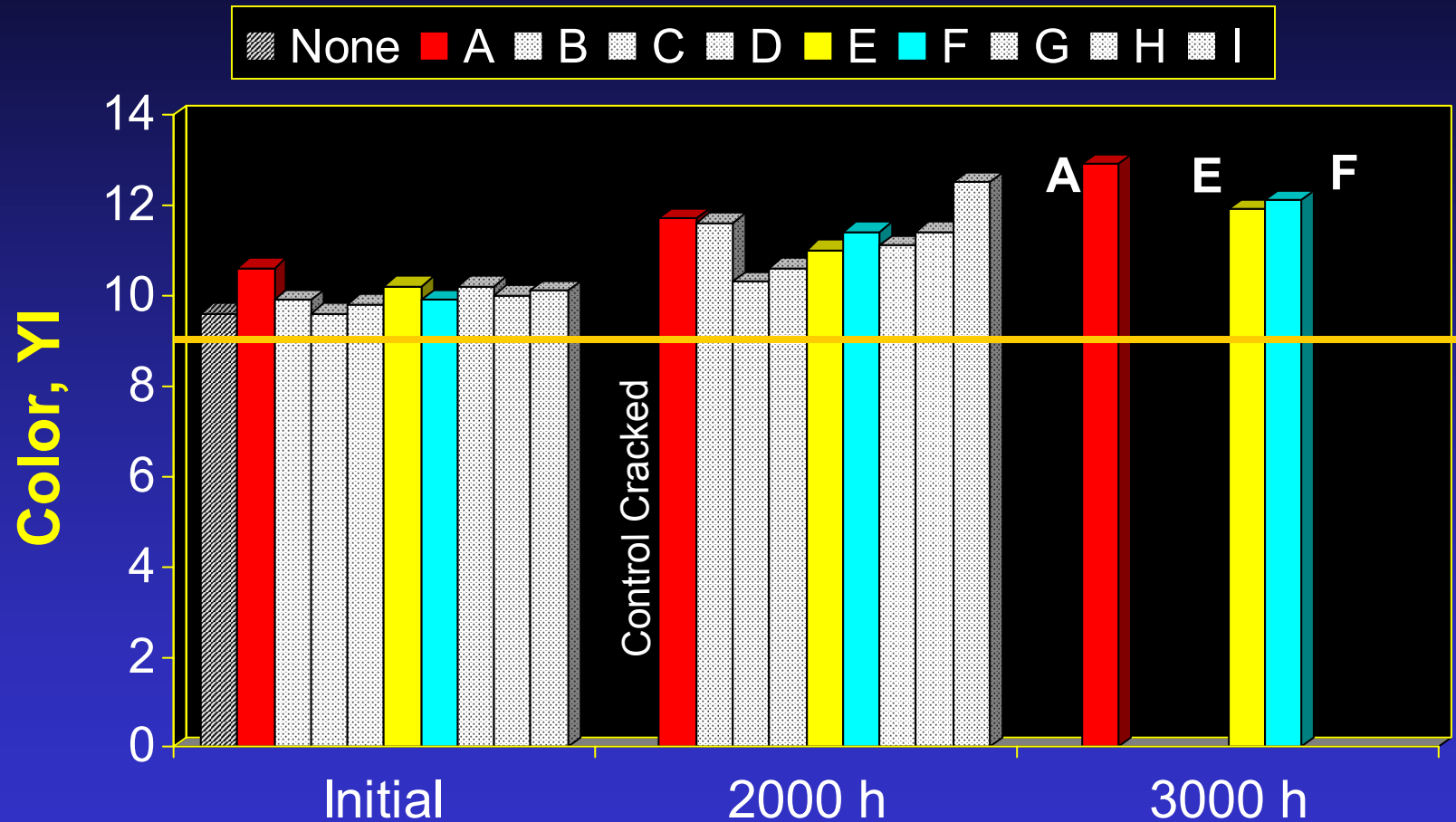
100 h

1015 h

2127 h

3000 h

Color Stability of Aliphatic Polyurea Coatings Based on Clearlink 1000 with Ciba Stabilizers

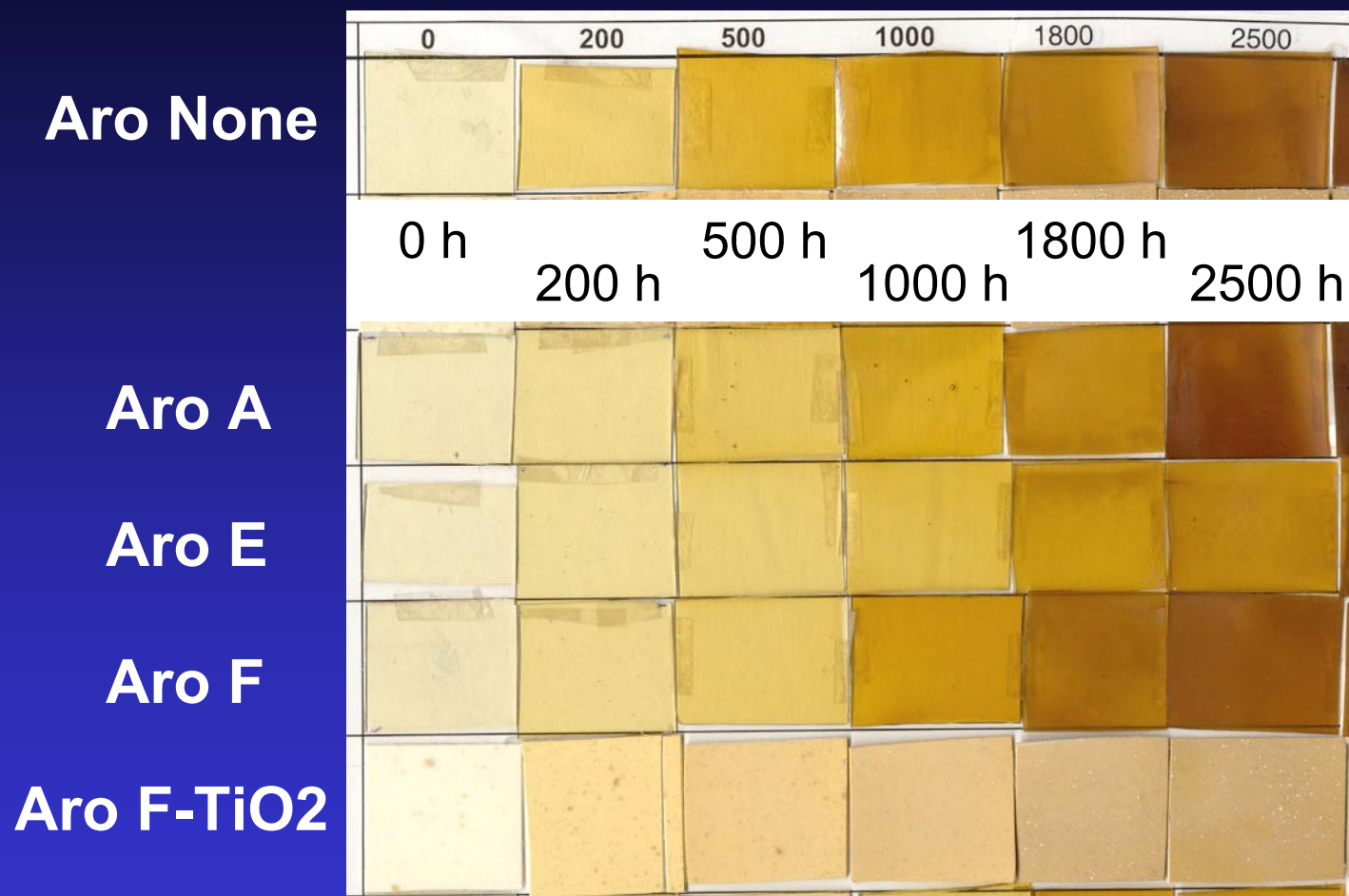


Xenon arc weatherometer (spray/63°C). Standard backup white tile YI value is 8.7.

General Formulation for the Aromatic Polyurea Coatings

A-Side	Rubinate 9495 (%)	100.0
	% NCO	15.2
	Index	105
B-Side	JEFFAMINE D-2000 (%)	54.8
	Unilink 4200 (%)	31.5
	DETDA (%)	12.1
	Stabilizer (%)	1.60
Processing	Volume Ratio (A/B)	1.00
	Cartridge Temperature (C)	23

Photograph of the Aromatic Test Specimens



Photographs of Ali F versus Aro F Coatings During Weatherometer Testing

Ali F



0 h

3000 h

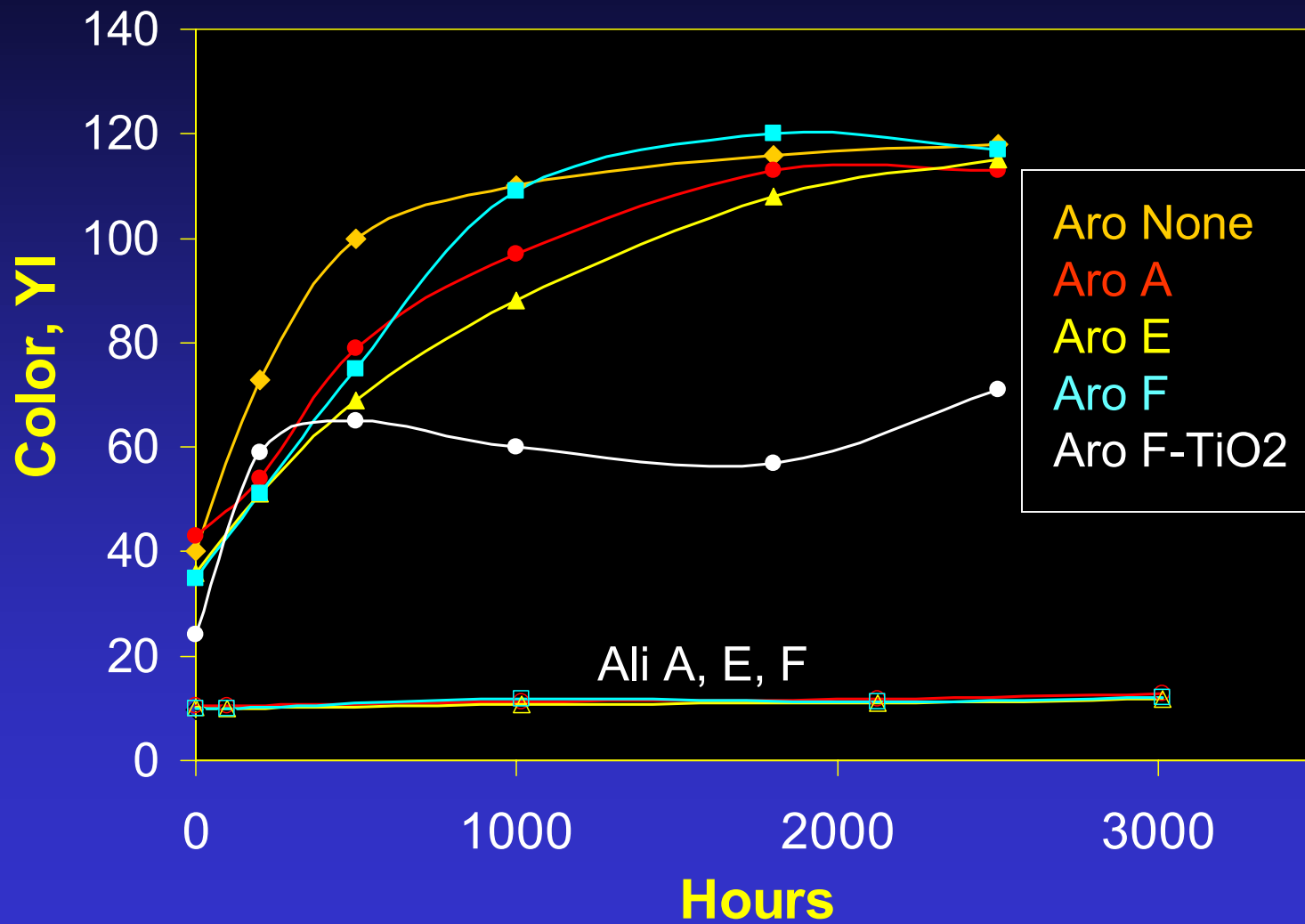
Aro F



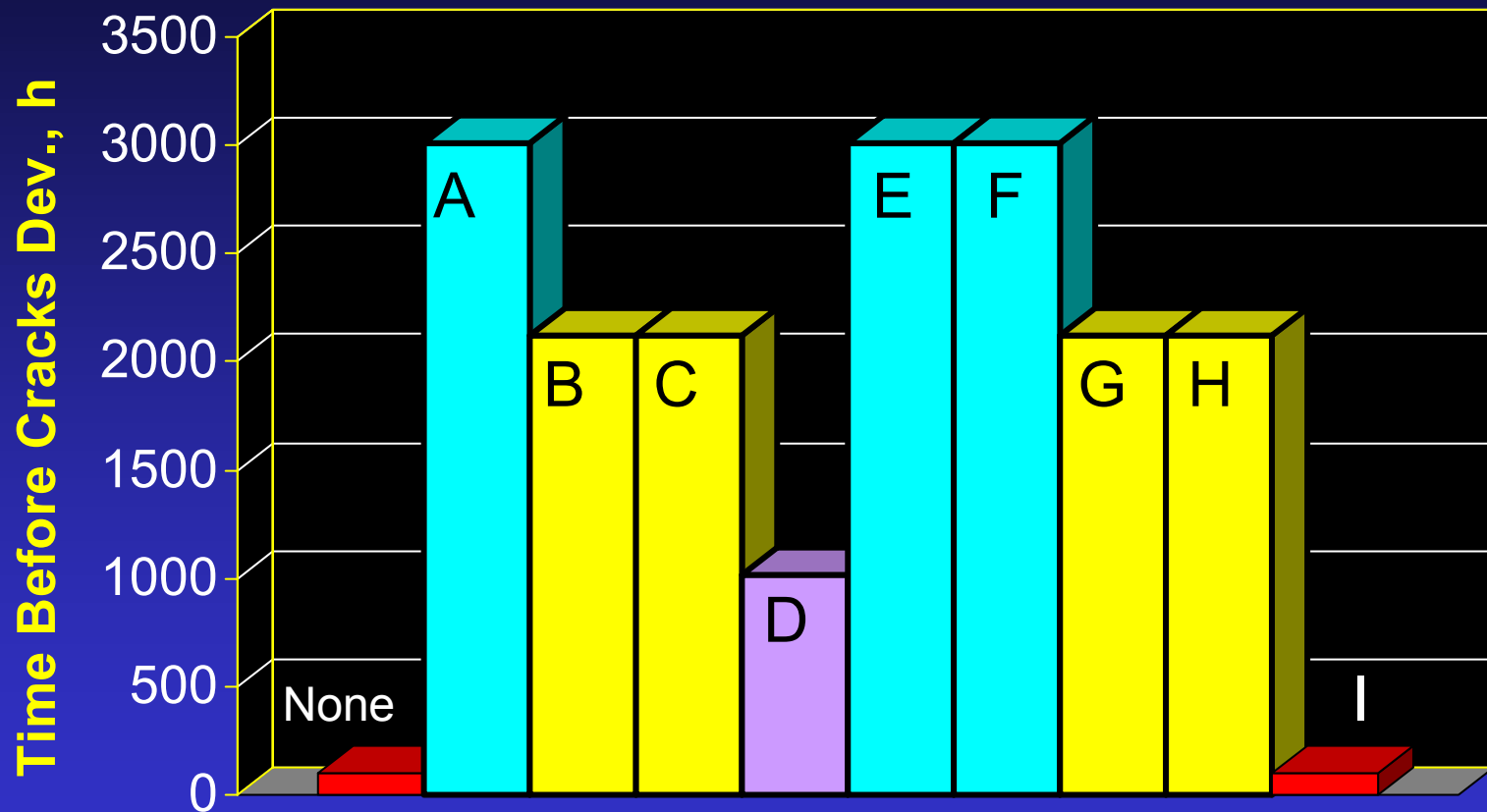
0 h

2500 h

Comparison of the Aliphatic and the Aromatic Coatings



Crack Development of Polyurea Coatings Based on Clearlink 1000 with Ciba Stabilizers



Xenon arc weatherometer (spray/63°C).

Conclusions

- * The aliphatic polyurea coatings tested were light stable, but...
- * They were not mechanically stable after 100 hours in the weatherometer

- * The aromatic polyurea coatings were mechanically stable, but...
- * They were not light stable and yellowed badly

Conclusions

- * Adding 0.75% by weight of a suitable stabilizer to the aliphatic coatings increased their crack resistance 30-fold, from 100 up to 3000 hours
- * The same stabilizers were unable to successfully retard yellowing in the aromatic polyurea coatings

Conclusions

- * Although photoinitiated radical attack on the aromatic groups causes the aromatic coatings to yellow significantly, this “radical scavenging” appears to help protect the integrity of the polymer backbone

Acknowledgement

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