

**EASTMAN**

# **Eastman specialty ketones**

Enabling low-VOC refinish coatings

## Situation assessment

What's driving the adoption of low-VOC refinish coating technology?

National consumption tax and emission charge

+

Mandatory regional VOC emission standards

## The challenge

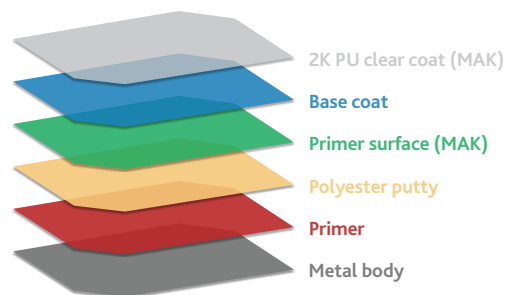
Formulators must comply with regional VOC emission standards without sacrificing performance. They must also avoid incurring new taxes and penalties as they create new formulations.

## A proven solution

The excellent solubility, appropriate evaporation rate, and low density of Eastman MAK (methyl *n*-amyl ketone) enable lower-VOC coatings with better appearance and workability. In addition, MAK provides lower viscosity, longer pot life, and better appearance based on the same resin system. Formulators who use MAK can broaden their resin selection and improve drying performance.

Eastman MAK attributes:

- Excellent solvent activity
- High dilution ratio
- Low density
- Low surface tension
- Non-HAP
- Non-SARA
- REACH compliant
- Readily biodegradable
- Slow evaporation rate
- Urethane grade



NOTE: Starting point formulations for high-solids clear coat are available on request. If additional assistance is needed, ask to speak with your technical service representative.

## Solubility, evaporation rate, and density

The excellent solubility, appropriate evaporation rate, and low density of MAK enable lower-VOC coatings with better appearance and workability.

Figure 1. Calculated VOC comparison

Solvent	Solution viscosity (cP)		Evaporation rate (vs. <i>n</i> -BAc)	Specific gravity, kg/L	Calculated VOC, <sup>a</sup> g/L
	HS-3-6T polyester	Joncryl <sup>®</sup> 502 acrylic			
MAK	94	92	0.4	0.818	409
Xylene	102	165	0.7	0.865	418
Aromatic 100	154	203	0.29	0.873	419
PMA	198	160	0.4	0.970	436

<sup>a</sup>Calculated VOC (g/L) = 1000 x (1 solid %) x paint density; calculation paint density = resin density x solid % + solvent density x (1 solid %); solid % is 58.3%; calculation by *n*-butyl acetate meets 420 g/L VOC compliance; resin density is 1.1 kg/L



## Eastman MAK in refinish clear coat (480 g/L)

MAK provides lower viscosity, longer pot life, and better appearance based on the same resin system

Figure 2. Refinish clear coat formulation 1

Formulation (weight)	MAK	PMA
Middle-solids acrylic resin	35.00	35.00
High-solids acrylic resin	14.00	14.00
Butyl acetate	13.63	13.63
MIBK	7.50	7.50
Wetting additives	0.34	0.34
DBTDL	0.03	0.03
EEP	8.00	8.00
MAK	8.00	0.00
PMA	0.00	8.00
HDI trimer hardener (81% in BAC)	24.50	24.50
<b>Total</b>	<b>111.00</b>	<b>111.00</b>
VOC (g/L)	475	483

Figures 3, 4, 5, and 6 show the test results of refinish clear coat formulation 1.

Figure 3. Viscosity performance

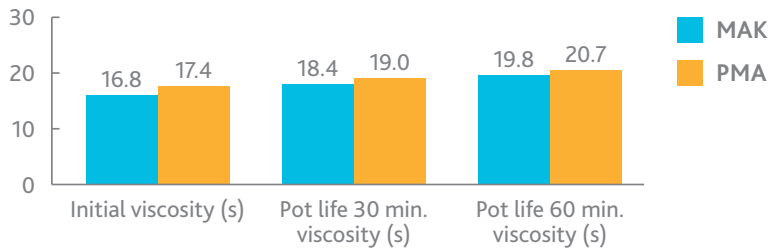


Figure 4. LW comparison

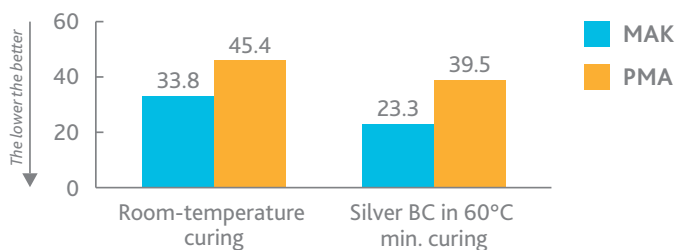


Figure 5. SW comparison

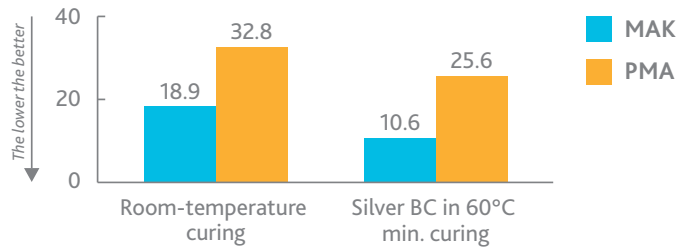
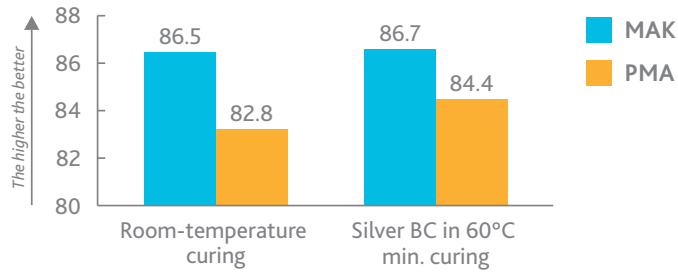


Figure 6. DOI comparison



Besides excellent film and appearance performance, MAK also enables formulators to broaden resin selection and improve drying performance.

Figure 7. Dry time comparison

Formulation (weight)	MS:HS = 70:30 with MAK	MS:HS = 50:50 with PMA
Middle-solids acrylic resin	70.0	50.0
High-solids acrylic resin	27.9	46.7
Xylene	10.0	10.0
DBTDL	0.1	0.1
Wetting additives	0.5	0.5
Butyl acetate	39.2	40.4
MIBK	10.0	10.0
MAK	14.0	0.0
PMA	0.0	14.0
HDI trimer hardener (81% in BAC)	49.0	49.0
<b>Total</b>	<b>220.7</b>	<b>220.7</b>
VOC (g/L)	480	480
Initial viscosity (DIN 4) (s)	16.6	17
Pot life 1-h viscosity (DIN 4) (s)	18.5	18.6
LW on silver BC	7.5	8.5
SW on silver BC	9.9	7.2
DOI on silver BC	87.7	88.1
<b>Dry to handle (h)</b>	<b>3.75</b>	<b>4.5</b>

## Eastman MAK in refinish clear coat (420 g/L)

MAK provides lower viscosity, longer pot life, and better appearance based on the same resin system.

Figure 8. Refinish clear coat formulation 2

Formulation (weight)	MAK	PMA
High-solids acrylic	98.7	98.7
Additive solution in BAC	8.4	8.4
MIBK	8.0	8.0
BAC	10.0	10.0
EEP	10.0	10.0
PMA	0.0	24.0
MAK	24.0	0.0
HDI trimer hardener (81% in BAC)	53.0	53.0
<b>Total</b>	<b>212.1</b>	<b>212.1</b>
Solid (%)	58.31	58.65
Density	1000.5	1021.9
VOC	417.1	422.6
Popping issue	Better	Good

Figures 9, 10, 11, and 12 show the test results of refinish clear coat formulation 2.

Figure 9. Viscosity comparison

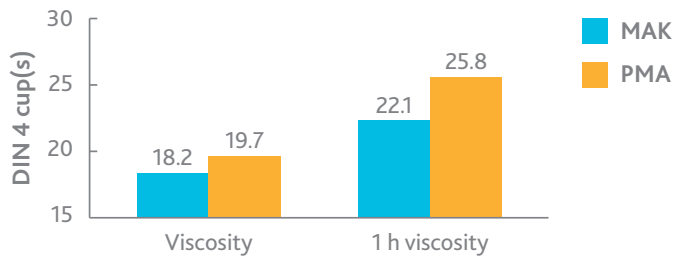


Figure 10. LW comparison

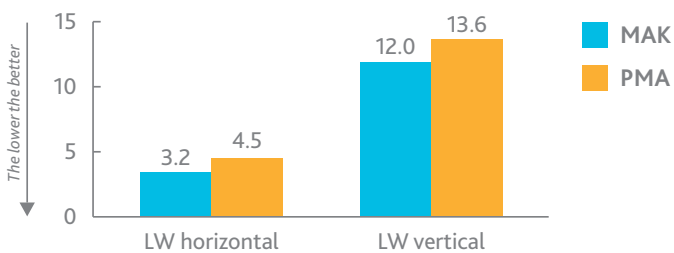


Figure 11. SW comparison

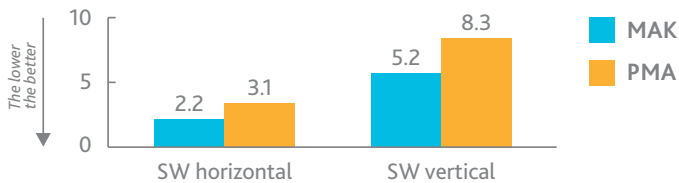
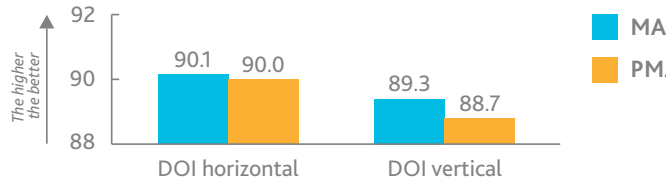


Figure 12. DOI comparison



Eastman MAK, in particular, can provide formulators a means to achieve smooth films and high gloss in 480- and 420-g/L VOC 2K formulations. Refinish clear coats, primers, and other 2K systems will certainly benefit from the low density, high activity, slow evaporation rate, and fast release provided by ketone solvents.

Eastman MAK is highly recognized by most leading global refinish formulators as an effective choice for their commercialized high-solids refinish coatings.



**Eastman Chemical Company  
Corporate Headquarters**

P.O. Box 431  
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)  
Other Locations, +(1) 423-229-2000

[www.eastman.com/locations](http://www.eastman.com/locations)

Although the information and recommendations set forth herein are presented in good faith, Eastman Chemical Company and its subsidiaries make no representations or warranties as to the completeness or accuracy thereof. You must make your own determination of its suitability and completeness for your own use, for the protection of the environment, and for the health and safety of your employees and purchasers of your products. Nothing contained herein is to be construed as a recommendation to use any product, process, equipment, or formulation in conflict with any patent, and we make no representations or warranties, express or implied, that the use thereof will not infringe any patent. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS AND NOTHING HEREIN WAIVES ANY OF THE SELLER'S CONDITIONS OF SALE.

Safety Data Sheets providing safety precautions that should be observed when handling and storing our products are available online or by request. You should obtain and review available material safety information before handling our products. If any materials mentioned are not our products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

© 2016 Eastman Chemical Company. Eastman brands referenced herein are trademarks of Eastman Chemical Company or one of its subsidiaries or are being used under license. The ® symbol denotes registered trademark status in the U.S.; marks may also be registered internationally. Non-Eastman brands referenced herein are trademarks of their respective owners.