EASTMAN

Eastman cellulose ester—Technical tip

Two-pack acrylic urethane wood coatings

Two-pack acrylic urethane wood coatings were prepared with Acrylamac™ 232-1639 acrylic resin and Eastman cellulose acetate butyrate CAB-381-0.5 in combination with Tolonate™ HDB-75 MX isocyanate from VencoreX.

In summary, the benefits were:

- Fast sand dry time.
- Addition of Eastman CAB 381-0.5 improved early hardness development.
- Pot life increased with increased CAB content.
- Excellent chemical resistance.
- Curing at higher temperatures was beneficial.

Coatings were prepared with and without CAB at 24% total solids content. The sand dry time and hardness development were determined after the coatings were drawn down on glass at 200 µm wet film thickness (WFT). Coatings were also prepared at 20 seconds DIN 4 spray viscosity and spray applied to veneered wood panels. The chemical resistance of those coatings was evaluated after 7 days at 23°C. The pot life of coatings prepared at 20 seconds DIN 4 viscosity was also evaluated.

The results shown on the following pages illustrate the effect of adding Eastman CAB-381-0.5 to two-pack acrylic urethane wood coatings. All the coatings were sand dry within 10 minutes. Hardness development during the first 5 hours of curing is significantly improved as the level of CAB in the coating is increased. All the coatings had excellent chemical resistance. The pot life of the coatings increased as the level of CAB in the coatings increased. However, the decrease in solids content as the level of CAB in the coating increased is also a factor in increasing pot life.

The use of CAB in two-pack acrylic urethane wood coatings enables the application of coatings at solids content that allows the open pore texture and characteristics of wood to be highlighted. Addition of CAB maintains sand dry time at lower solids content with improved early hardness development. These characteristics enable the efficient coating of wood with two-pack acrylic urethane coatings.

The excellent chemical resistance found indicated that high quality coatings can be produced with the combination of Acrylamac™ 232-1639 acrylic resin and Eastman cellulose acetate butyrate CAB-381-0.5 with Tolonate™ HDB-75 MX isocyanate from VencoreX.

Though not reported here, similar results were obtained at 23°C using Tolonate™ HDT-90 isocyanate from VencoreX.

Table 1 **Coatings formulated at 24% total solids content**

(All coatings formulated with 1:1 OH:NCO stoichiometry)

	Acrylamac™ 232-1639: Eastman CAB-381-0.5		
	1:0	1:0.3	1:0.8
Acrylamac™ 232-1639 acrylic resin[a] (50%) (xylene:*n*-butyl acetate-1:1)	39.2	30.6	22.3
Eastman cellulose acetate butyrate CAB-381-0.5[b] (20%) (ethyl acetate:MIBK:PMA-6.0:3.4:0.6)	—	22.9	44.7
Solvent blend[c]	55.0	41.0	27.9
Tolonate™ HDB-75 MX[d]	5.8	5.5	5.1
Total	100.0	100.0	100.0
Theoretical % total solids content	24.0	24.0	24.0

[a] *PCCR USA, –2.0% OH content on resin solids.*

[b] *Eastman Chemical Company, 1.3% OH content.*

[c] *Solvent blend: 60.0 ethyl acetate—34.0 MIBK (methyl isobutyl ketone)—6.0 Eastman PM acetate.*

[d] *VencoreX, 16.5% NCO content as supplied.*

Figure 1 **Sand dry time**

(Acrylamac™ 232-1639 acrylic resin:Eastman CAB-381-0.5 with Tolonate™ HDB-75 MX @ 23°C [DIN 53 150] [200 microns WFT on glass])

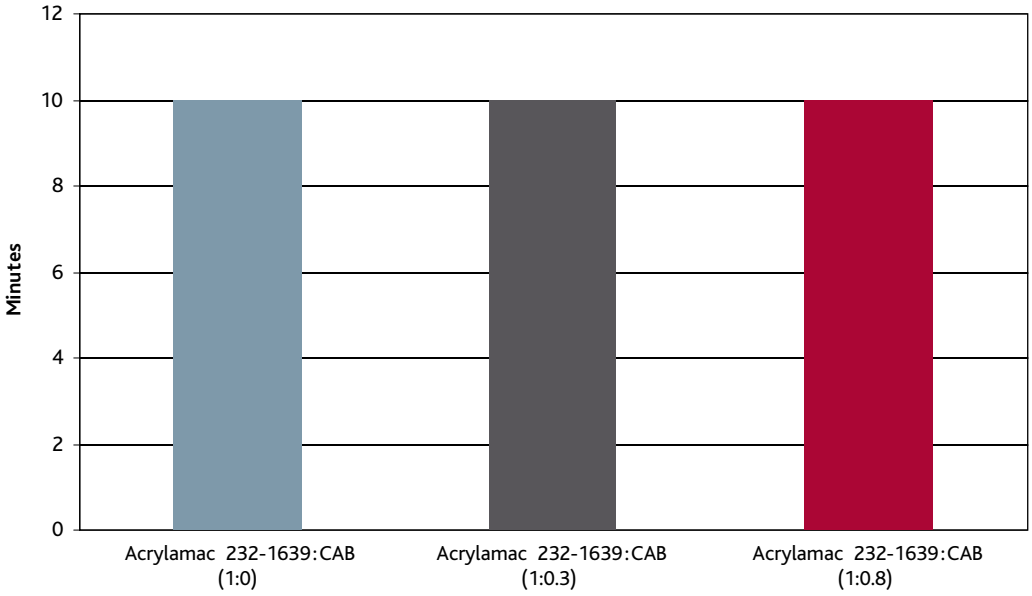


Figure 2 **Hardness development (minutes)**

(Acrylamac™ 232-1639 acrylic resin:Eastman CAB-381-0.5 with Tolonate™ HDB-75 MX @ 23°C [200 micron WFT on glass])

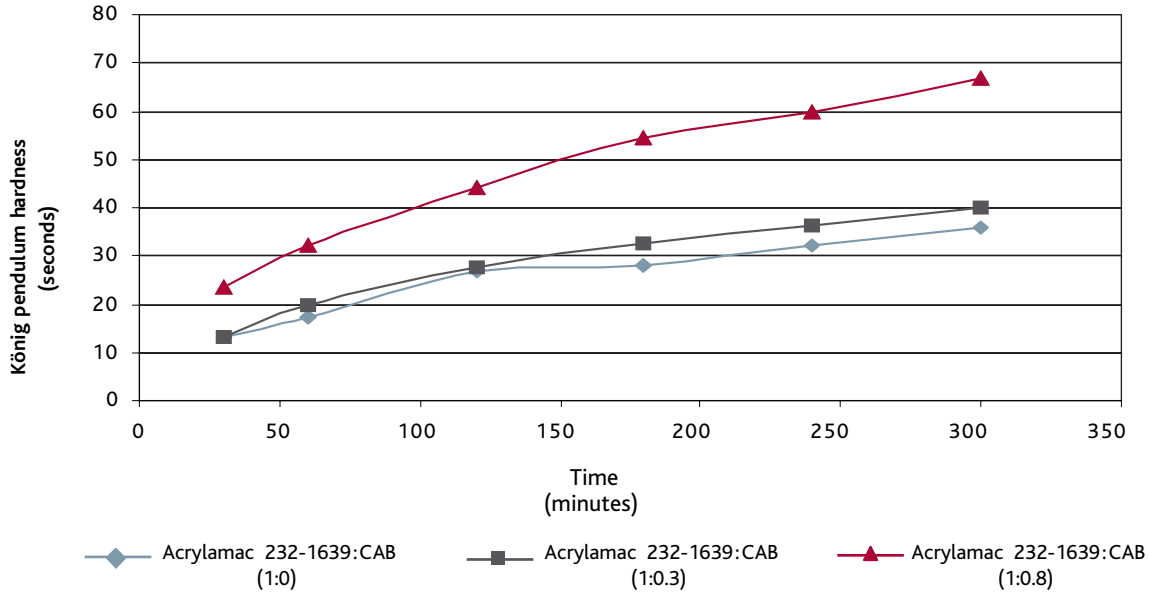


Figure 3 Hardness development (hours)

(Acrylamac™ 232-1639 acrylic resin:Eastman CAB-381-0.5 with Tolonate™ HDB-75 MX @ 23°C [200 microns WFT on glass])

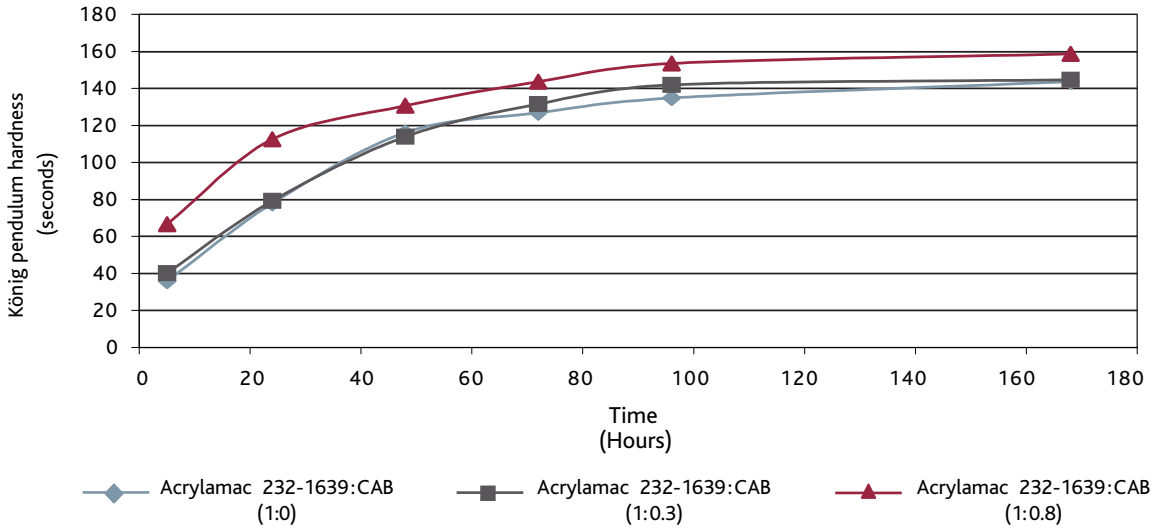


Table 2 Coatings formulated @ 20 seconds DIN 4 viscosity

(All coatings formulated with 1:1 OH:NCO stoichiometry)

	Acrylamac™ 232-1639: Eastman™ CAB-381-0.5		
	1:0	1:0.3	1:0.8
Acrylamac™ 232-1639 acrylic resin[a] (50%) (xylene:*n*-butyl acetate-1:1)	59.0	32.4	18.7
Eastman cellulose acetate butyrate CAB-381-0.5b (20%) (ethyl acetate:MIBK:PMA-6.0:3.4:0.6)	—	24.2	37.3
Solvent blend[c]	32.2	37.6	39.8
Tolonate™ HDB-75 MX[d]	8.8	5.8	4.2
Total	100.0	100.0	100.0
DIN 4 viscosity (seconds)	20.2	20.0	20.2
Theoretical % total solids content	36.1	25.4	20.0
Specific gravity	0.9626	0.9345	0.9220
VOC (g/L)	615	697	738

[a]*PCCR USA, –2.0% OH content on resin solids.*

[b]*Eastman Chemical Company, 1.3% OH content.*

[c]*Solvent blend: 60.0 ethyl acetate—34.0 MIBK (methyl isobutyl ketone)—6.0 Eastman PM acetate.*

[d]*VencoreX, 16.5% NCO content as supplied.*

Table 3 **Pot life[a] with Tolonate™ HDB-75 MX @ 23°C, DIN 4 viscosity—seconds**

Resin:Eastman CAB-381-0.05	Hours								
	0	7	24	48	72	79	96	103	168
1:0	20.2	25.5	44.2	—	—	—	—	—	—
1:0.3	20.0	20.7	22.0	24.8	28.0	29.5	46.0	—	—
1:0.8	20.2	20.8	21.5	21.8	22.7	22.2	23.7	24.0	—

[a]*Pot life defined as time taken for viscosity to double*

Figure 4 **Pot life**

(Acrylamac™ 232-1639 acrylic resin:Eastman CAB-381-0.5 with Tolonate™ HDB-75 MX @ 23°C)

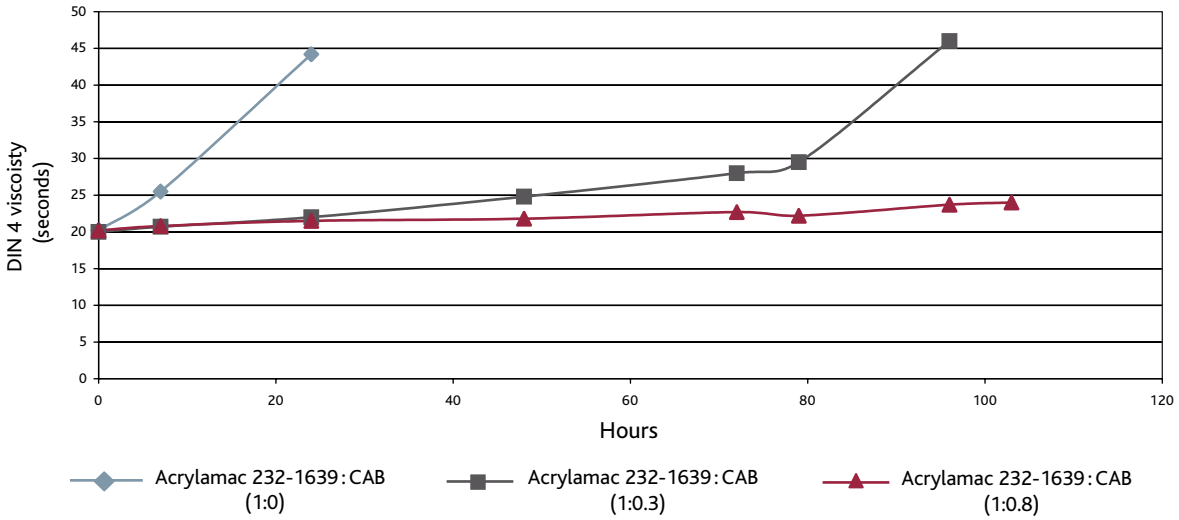


Table 4 **Chemical resistance with Tolonate™ HDB-75 MX (DIN 68 681)**

		Acrylamac™ 232-1639:Eastman CAB-381-0.5		
		1:0	1:0.3	1:0.8
Chemical	Test period	Initial resistance/resistance after 72 h		
Acetone	10 seconds	0/0	0/0	0/0
10% Ammonia	2 minutes	0/0	0/0	0/0
48% Ethanol	1 hour	0/0	0/0	0/0
80% Acetic acid	1 hour	3/0	3/0	3/0
Mustard	5 hours	0/0	0/0	0/0
DBP	5 hours	0/0	0/0	0/0
Red wine	5 hours	0/0	0/0	0/0
Coffee	16 hours	0/0	0/0	0/0
Evaporated milk	16 hours	0/0	0/0	0/0
Water	16 hours	0/0	0/0	0/0
Skin cream	24 hours	0/0	0/0	0/0

Key: 0—No visible damage
1—Coating slightly changed in color or gloss (changes disappear within 10 minutes)
2—Coating slightly changed in color or gloss (changes disappear within 60 minutes)
3—Visible and durable changes to coating
4—Change in structure of the coating
5—Coating destroyed

Influence of temperature on hardness

To evaluate the effect of cure at elevated temperature on hardness development, a series of coatings were prepared at the same ratios of acrylic resin:CAB as in Table 1. These coatings were prepared at 30% total solids content. A 1% solution of Di-*n*-butyltindilaurate in *n*-butyl acetate was added at 0.02% on resin solids as catalyst. The coatings were drawn down on glass, allowed to dry for 10 minutes at 23°C and placed in an oven for 10, 20, 30, or 60 minute cures. The coatings were allowed to cool for 10 minutes before initial König pendulum hardness measurements were taken. The evaluations were carried out at 30°C and 45°C. The results of these evaluations showed the following benefits:

- As the previous results showed, increasing the amount of Eastman CAB-381-0.5 in the coating formulation corresponded to an increase in initial König pendulum hardness.
- The initial hardness was accelerated at higher temperatures.

Figure 5 **Initial hardness development**

(Acrylamac™ 232-1639 acrylic resin:Eastman CAB-381-0.5 with Tolonate™ HDN-75 MX [100 microns WFT on glass])

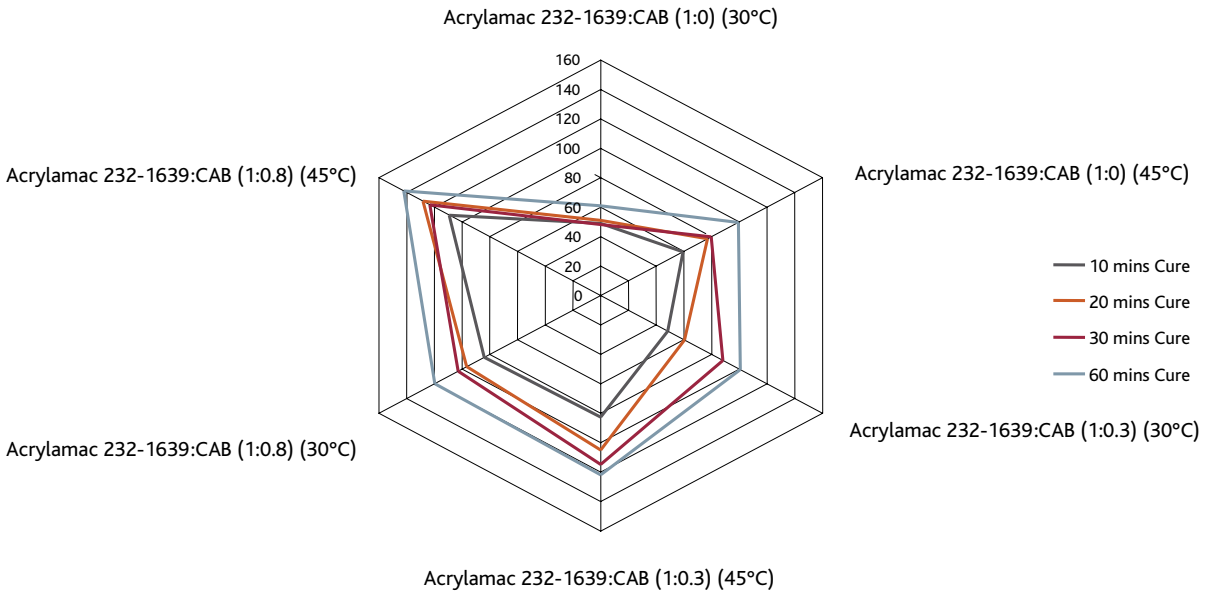
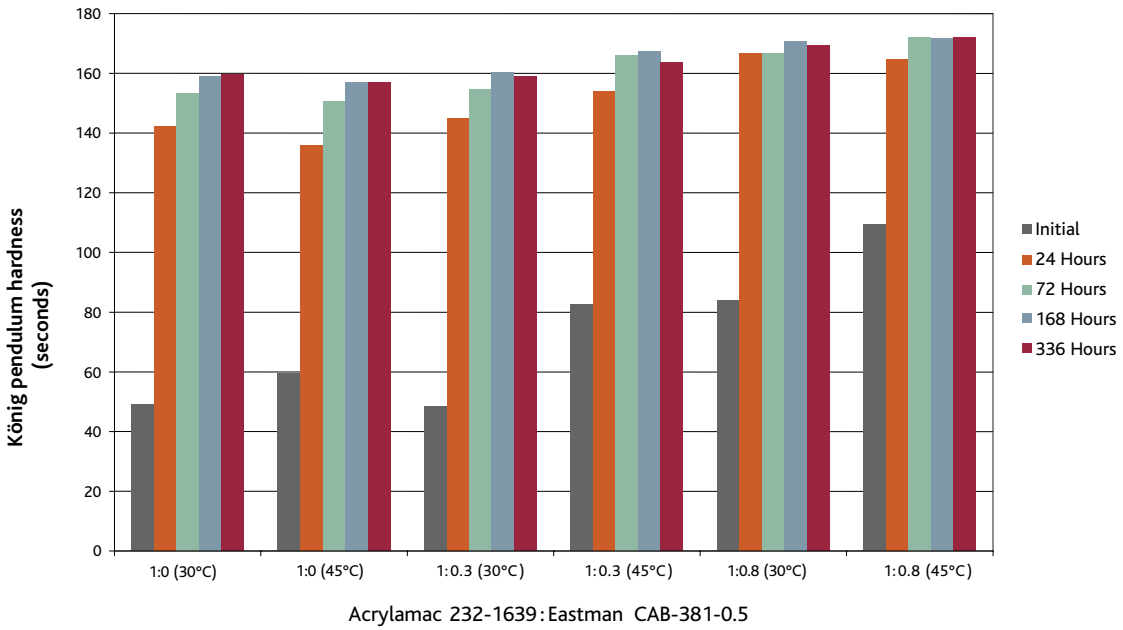


Figure 6 **Hardness development**

[Acrylamac™ 232-1639 acrylic resin:Eastman CAB-381-0.5 with Tolonate™ HDB-75 MX—10 minutes cure time (100 microns WFT on glass)]



EASTMAN

Eastman Chemical Company
Corporate Headquarters
P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

Telephone:
U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations, (1) 423-229-2000
Fax: (1) 423-229-1193

Eastman Chemical Latin America
9155 South Dadeland Blvd.
Suite 1116
Miami, FL 33156 U.S.A.

Telephone: (1) 305-671-2800
Fax: (1) 305-671-2805

Eastman Chemical B.V.
Fascinatio Boulevard 602-614
2909 VA Capelle aan den IJssel
The Netherlands

Telephone: (31) 10 2402 111
Fax: (31) 10 2402 100

Eastman (Shanghai) Chemical Commercial Company, Ltd. Jingan Branch
1206, CITIC Square
No. 1168 Nanjing Road (W)
Shanghai 200041, P.R. China

Telephone: (86) 21 6120-8700
Fax: (86) 21 5213-5255

Eastman Chemical Japan Ltd.
MetLife Aoyama Building 5F
2-11-16 Minami Aoyama
Minato-ku, Tokyo 107-0062 Japan

Telephone: (81) 3-3475-9510
Fax: (81) 3-3475-9515

Eastman Chemical Asia Pacific Pte. Ltd.
#05-04 Winsland House
3 Killiney Road
Singapore 239519

Telephone: (65) 6831-3100
Fax: (65) 6732-4930

www.eastman.com

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