

# MPO Application in Polyurethanes

MPO is used in the polyurethane industry and provides the same benefits as observed in polyesters:

- Low viscosity and high compatibility makes it an easy reactive dispersant for additives and for catalysts.
- VOC free coating.
- Low Tg offers excellent adhesion in formulation.
- Powder coating ingredient to provide UV resistance.
- Improves clarity by adding amorphicity.
- Good abrasion resistance.
- Good compression-set.



## MPO for Low Durometer Polyurethanes

Low viscosity curative blend made from MPO derivatives is used as build-in plasticizers, offering low durometer parts like luggage rollers, printing rolls, cushion mats etc. No leaching. The liquid polyester polyol blends offer easy handling, high hydrolytic stability and wear and tear resistance.

	PROCESSING CONDITIONS			PHYSICAL PROPERTIES								
	Prepol °C	Curative °C	Gel Time	Hardness	100% Mod	300% Mod	Tensile psi	Compression set %	Elongation %	Rebound in %	Die C psi	Elongation set %
Curative blend + 3% TDI prepol												
MPDA/CA6010/GC100	97	60	1'50", demold <42min	55A	214	300	1185	39	848	43	127	
MPDA/CA6020/GC100	100	60	1'50" / non-tacky after 30 min	55A	246	319	1842	39	1097	46	126	6
MPDA/CA6020/GC100	100	60	3min / 30min dm	50A	155	202	1341		1183	44	111	15
MPDA/CA6020/GC100	100	50	5.5 min / 3 hr non tacky	46A	182	251	1629	45	1068	45	83	8.9
MOCA/Benzo 5%	~100	100	12 min	45A	175	253	2143	36	951	22	124	4.7

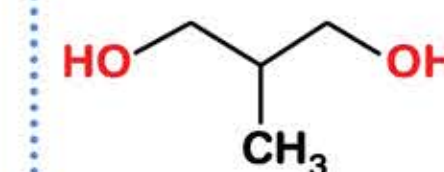
## Carpet Binder

MPO is beneficial as a major chain extender in carpet-backing binder. Yielding increases in tuft bind and elongation when used alone or with other chain extenders. In comparison to DEG, 1,3-PDO, MPO offers higher tuft bind and higher elongation at lower compression-set.

US 6171678 B1

Example	C4	C5	12
<b>Component</b>			
Polyol B	65.0	68.4	67.4
Polyol C	18.9	19.6	19.3
Diethylene glycol	15.2	-	-
1,3-propanediol	1	12	1
2-methyl-1,3-propanediol	-	-	13.4
Wetting Agent	1	1	1
Calcium Carbonate	150	150	150
Ave. Polyol Functionality	2.4	2.4	2.4
LC5615	1.5	1.5	1.5
Baytuft 751	54.9	59.7	56.8
<b>Physical and Chemical Characteristics</b>			
% Hard Segment	45	45	45
Density (lb/ft <sup>3</sup> )	32	29	30
Tuft bind (lb)	13.0	14.4	15.6
Applied Weight (ox/yd <sup>2</sup> )	35.6	34.6	33.8
Tensile	130	142	120
Elongation (%)	52	53	96
Compression Set (25% @ 23°C)	18.5	16.2	5.2

Example	9	10	11	C3
<b>Component</b>				
Polyol A	81	57	41	-
Polyol B	-	-	-	62.5
Polyol C	-	-	-	17.5
Polyol D	-	24	40	-
Diethylene glycol	9.5	9.5	9.5	-
2-methyl-1,3-propanediol	9.5	9.5	9.5	-
Wetting agent	1	1	1	1
Calcium Carbonate	150	150	150	150
LC5615	1.5	1.5	1.5	1.5
Baytuft 751	74.6	74.4	74.2	68.8
<b>Physical and Chemical Characteristics</b>				
% Hard Segment	53.5	53.5	53.5	53
Polyol Functionality	2.4	2.4	2.4	2.4
Elongation (%)	108	80	80	25



## 2-Methyl-1, 3-Propane Diol

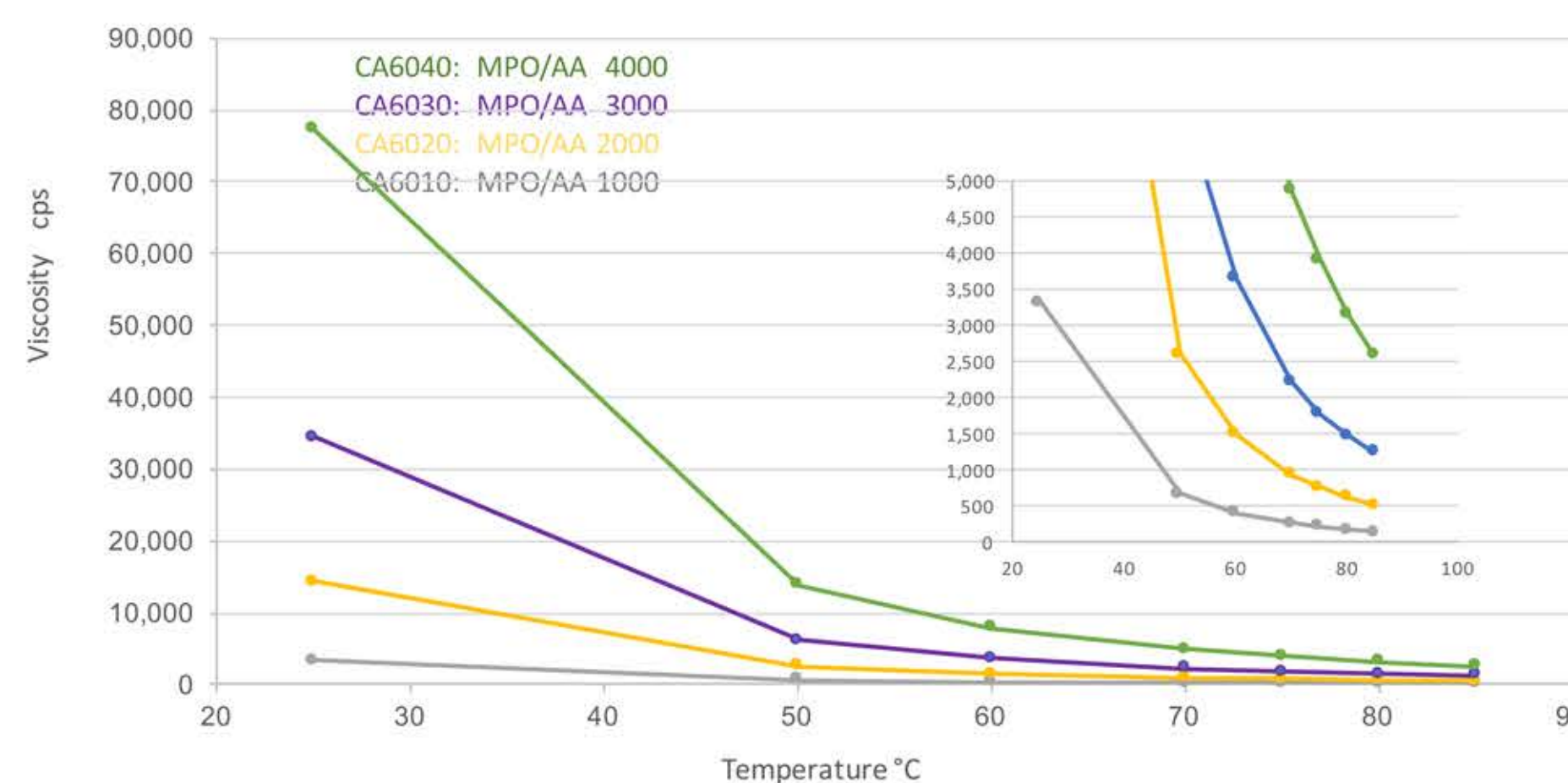
A clear, colorless, low viscosity diol containing two primary OH groups and a methyl side chain



Freeze Point ..... -54 °C  
 Boiling Point ..... 212 °C  
 Viscosity (20 °C) ..... 178 cps / 178 mPas  
 Solubility in Water ..... 100%  
 Flash Point (Closed Cup Method) ..... 127 °C

## Liquid MPO Polyester Polyols

MPO Adipates	MW Avg	Water %wt	Acid Value mgKOH/g	OH Value mgKOH/g	Color APHA	Viscosity cps 25C
CA6010	1000	<0.05	<0.5	106-118	<50	3,000
CA6020	2000	<0.05	<0.5	53-59	<50	13,000
CA6030	3000	<0.05	<0.5	36-40	<50	35,000

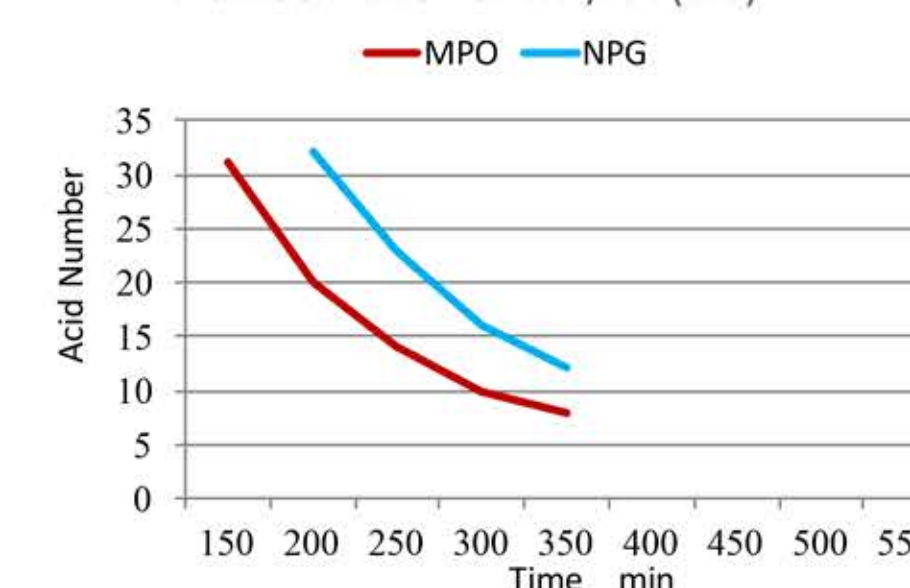


# MPO Application in Polyesters

MPO as a raw material in production:

- Low odor, minimal ventilation, high purity liquid.
- No regulatory restrictions.
- Less hygroscopic than BDO, DEG, PG.
- Good abrasion resistance.
- Improves compatibility and mixing.
- Easy to pump and no need to preheat.
- Faster reaction speed than MPG, NPG.

Reaction Times for Diols vs. Acid Number. 210 °C. IPA/AA (1:1)



MPO Compares to NPG:

- Easy production handling
- Low storage and transportation cost
- Low viscosity for easy transfer
- Does not sublime/accumulate on reactor dome
- Similar UV resistance performance
- Similar water resistance performance
- Better low temperature performance
- Good economics
- Lower MW, allows higher acid section content
- Shorter reaction time improves color

## VOC-Free TOP-Coat

MPO/AA polyester polyol was used in wood top-coat formulations. Performance with DEG/AA polyester polyol at different MW were compared with different PMDIs; concrete pour test passed along with comparison group, no peel, no cracking of the coating were observed. Further field tests was applied to MPO based tope coat: flat plane tensile, cyclic temperature weathering, alkali resistant all passed.

US 2006/0057393 A1 \*additive added

	MW	MDI
DEG/AA	1000	PMDI 1
	2000	PMDI 2
	1000*	PMDI 1
MPO/AA	1000*	PMDI 3
	1000*	PMDI 1
	2000*	PMDI 3

## Aqueous Suspension Coating Abrasion Resistance Comparison among Diols

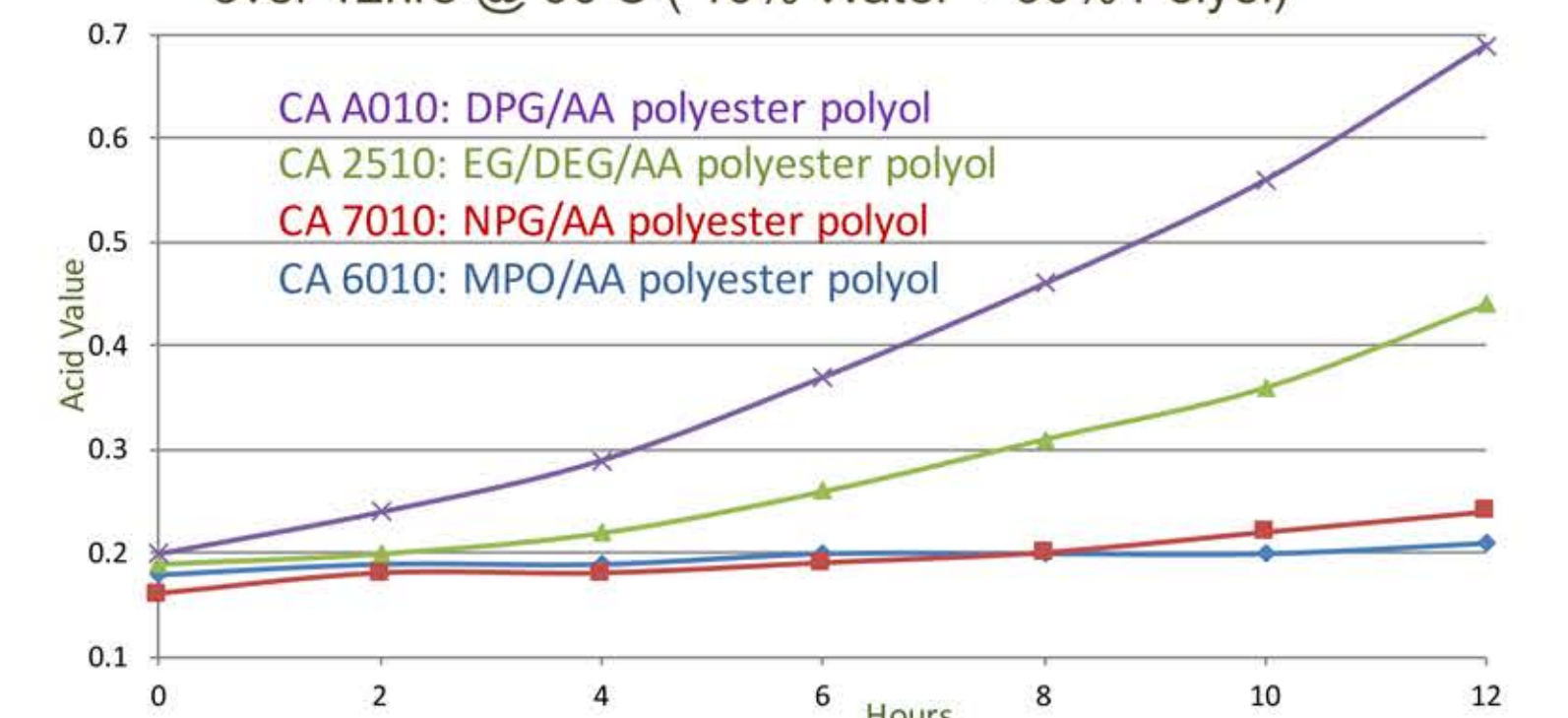
Nine diols were tested in parallel in an aqueous two-component floor coating formulation, the gloss change is recorded after abrasion of the cured surface.

"na" means sticky. US 20070287824 A1

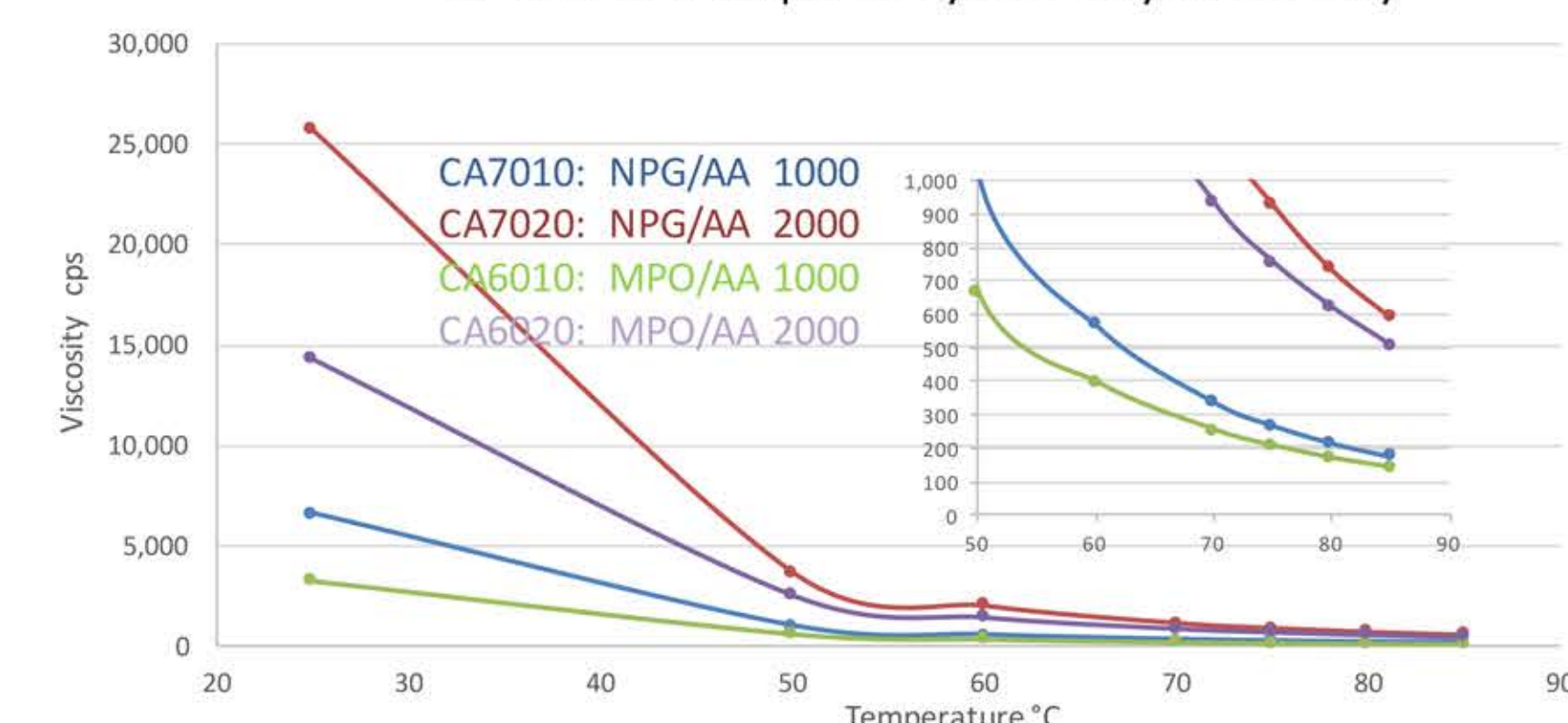
Diol	Initial Gloss	Abraded Gloss
CHDM	94	90
BDO	80	na
HDO	85	80
MPO	89	86
HQEE	40	na
MBOCA	0	na
EDA	0	na
EG	0	na
DEG	0	na
None	87	60

	MPO	BDO	NPG	MPG
<b>Reaction</b>				
Freeze Point	✓✓	xx	xx	✓✓
Handling	✓✓	x	xx	✓✓
Low Color	✓✓	✓	✓	✓
Esterification React	✓✓	x	✓	x
Urethane Ext.	✓	✓✓	-	-
<b>Polymer Properties</b>				
Hydrolytic Stability	✓✓	x	✓✓	x
UV Stability	✓	x	✓	x
Amorphous Polymer	✓✓	xx	✓	✓✓
Tensile Properties	✓	✓✓	-	-
<b>General</b>				
Low Cost	✓✓	✓	✓	✓✓
Availability	✓✓	✓	✓	✓✓

Hot water degradation test over 12hrs @ 90°C ( 10% Water + 90% Polyol)



MPO vs NPG Adipate Polyester Polyols Viscosity



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