TELETECH

Hydrolytic Stability Of Polyurethane Elastomers

Urethane
Prepolymers

HYDROLYTIC STABILITY OF POLYURETHANE ELASTOMERS

For many applications knowledge of the stability of polyurethane elastomers in water at elevated temperatures is of importance for selecting the best urethane. The following tests were run to compare several types of polyurethane elastomers.

> Samples (1" x 1" x ¼") were prepared in the laboratory and aged in water, 5% NaOH and 5% HCI for 8 weeks at 25°C, 60°C and 90°C. Volume swell, hardness and appearance was measured on each test specimen.

Each polyurethane was given a rating based on its aging characteristics in water, acid, and base. See attached table. These general conclusions can be made:

1. All urethane exhibited good stability in water in room temperature.

2. PTMG/MDI and PTMG/PPDI urethanes are best overall, especially at elevated temperatures.

3. Curing MDI/PTMG prepolymers with 1,4 Butanediol gives slightly better stability than HQEE cures.

4. PTMG/H_{12}MDI cured with MBCA or MCDEA exhibits performance similar to PTMG/MDI up to 90°C in water and 60°C in acid and base. Performance in acid and base at 90°C is poor.

5. Polycaprolactone MDI exhibits good stability in water, acid and base at low temperatures, however performance of elevated temperatures is similar to polyester/MDI urethane.

6. The use of Lonzacure MCDEA improves stability of PTMG/TDI and PTMG/H_{12} MDI over MBCA cures.

7. NDI-based material (Vulkollan) showed the characteristic poor stability of polyesters in all media.

Also attached is a table showing the effect of similar exposure on high-hardness (65-73D) Ether elastomers.

HYDROLYTIC STABILITY

HYDROLYTIC STABILITY RATING OF VARIOUS URETHANES
8 WEEK AGING IN AQUEOUS MEDIA

	WATER			5% NaOH			5% HCl		
TEMPERATURE	**25°C**	**60°C**	**90°C**	**25°C**	**60°C**	**90°C**	**25°C**	**60°C**	**90°C**
PTMG PPDI[3]/CHDM	1	1	1-2	1	1	1-2	1	1	1-2
PTMG/MDI/1,4 BD	1	1	1-2	1	1	1-2	1	1-2	1-2
PTMG/MDI/HQEE	—	2	2	—	1-2	2-3	—	2	2
PTMG/H_{12}MDI[1]/MCDEA	—	1	1-2	—	1-2	2	—	1	4
PTMG/H_{12}MDI/MBCA	1	1-2	1-2	1	1-2	3-4	1	1-2	4-5
PTMG/TDI/MCDEA[4]	1	1	2	1	1	3	1	2	4
PTMG/TDI/MBCA	1	2	4	1	2	4	1	2	4
PCL[2]/MDI/1,4 BD	1	2	4	1	2	5	1	4-5	4-5
ESTER/MDI/1,4 BD	1	3	5	1	4	5	1	5	5
ESTER/NDI[5]/1,4 BD	1	3-4	5	1-2	5	5	2	5	5
ESTER/TDI/MBCA	1	3	5	2-3	5	5	1-2	5	5

Ratings:
1 = Slight to no change
2 = Discolored, Tough
3 = Moderate Cheesiness
4 = Cheesy or Brittle
5 = Disintegrated

[1] H12 MDI = Aliphatic Diisocyanate
[2] PCL = Polycaprolactone
[3] PPDI = Para-phenylenediisocyanate
[4] Lonzacure MCDEA
[5] Vulkollan

HYDROLYTIC STABILITY

HIGH HARDNESS ETHER HYDROLYTIC STABILITY 60°C

	WATER			5% NaOH			5% HCl		
	4 wks.	8 wks.	16 wks.	4 wks.	8 wks.	16 wks.	4 wks.	8 wks.	16 wks.
LW570/MDEA	1 72D	1 73D	1 73D	1-2 74D	1-2 75D	1-2 75D	1 71D	1 73D	1 72D
LW570/MBCA	1 73D	1 76D	1-2 76D	1 75D	1-2 76D	1-2 75D	1 73D	1 76D	1 74D
M415/HQEE	1-2 66D	2 68D	2 68D	1-2 63D	1-2 71D	2 69D	2 66D	2 69D	2 66D
LF751/MBCA	1 71D	1 75D	1 73D	1 72D	1 75D	1 74D	1-2 72D	1-2 73D	1-2 72D

HIGH HARDNESS ETHER HYDROLYTIC STABILITY 90°C

	WATER			5% NaOH			5% HCl		
	4 wks.	8 wks.	16 wks.	4 wks.	8 wks.	16 wks.	4 wks.	8 wks.	16 wks.
LW570/MDEA	1 70D	1-2 74D	1-2 73D	1-2 71D	2 73D	2-3 74D	4 78A	4 55A	5 —
LW570/MBCA	1 72D	2 72D	2 75D	2 73D	2-3 74D	2-3 75D	3 62D	5 —	5 —
M415/HQEE	2 65D	2 68D	2 66D	1-2 67D	2-3 63D	2-3 67D	2 63D	2 69D	2 67D
LF751/MBCA	2 60D	2 61D	3 59D	2 64D	2-3 68D	4 42D	2 61D	4 63D	5 —

Conclusions:

60°C – All perform well, LW570/MCDEA is clear and discolors least, while M415 HQEE discolors the most.

90°C – In water and NaoH LF751/MBCA is the most affected. Again LW570/MCDEA discolors least and remains clear.

90°C – In HCL, M415/HQEE is the only one that survives 16 weeks.

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