

REFERENCES

- American Society for Testing and Materials. Annual book of ASTM standard
Vol. 08.01. Standard Test Methods for Tensile Properties of Thin
Plastic Sheeting, ASTM D 882-91, 1994.
- American Society for Testing and Materials. Annual book of ASTM standard
Vol. 08.01. Standard Practice for Outdoor Weathering of Plastics,
ASTM D 1435-85, 1994.
- Binns, M.R., and Others. A new technique for the study of reactive species
generated during the initial stages of polymer photodegradation.
Polymer Bulletin 27(1992): 421-424.
- Briston, J.M. Plastic Films. Lancaster: Technomic Publishing Co. Inc., 1983.
- Gachter, R., and Muller, H. Plastic Additive Handbook. New York: Macmillan
Publishing Co., 1985.
- Harry, R.A., and Frederick, W.L. Contemporary Polymer Chemistry. New
Jersey: Prentice -Hall, 1990.
- Hunt, B.J., and James, M.I. Polymer characterisation. Great Britain: St
Edmundsbury Press Ltd., 1993.
-

International Standard ISO Part 2. Standard Methods of exposure to laboratory light sources-Plastics, ISO 4892-2E, 1994.

Karen, K.L. Pigments and Other Additive that Influence The Degradation Rate of Polyethylene Films. Textile Chemist and Colorist 24(1992): 1-7.

Lee, Y.W. Weathering of photodegradation polyethylene in a sub-tropical climate environment. Polymer in Extreme Environments.

Nottingham: Rapra Technology Ltd., 1991.

Malcolm, P.S. Polymer chemistry. Oxford: Oxford University Press, Inc., 1990.

Malik, J., Tuan, D.G., and Spirk, E. Lifetime prediction for HALS-stabilized LDPE and PP. Polymer Degradation and Stability 47(1995): 1-8.

Matthan, J., and others. Ageing and Weathering of Plastics. Great Britain: The Rubber and Plastics Research Association, 1970.

Neter, J. Wasserman, W. and Whitmore, G.T. Applied Statistics. 4th ed. MA: Simon & Schuster, Inc., 1993.

Norman, G. Polymer degradation and stabilization. Cambridge University Press, 1985.

Norman, S., and others. Current Trends in Polymer Photochemistry. New York: Ellis Horwood Limited, 1995.

Oswin, C.R. Plastic Films and Packaging. Lodon: Applied Science Publishers, 1975.

Raab, M. Relative between degradation and mechanical behaviour of polymers.

International Polymer Science and Technology. 21(1994): 47-53.

Rymarz, G., Klecan, T., and Sobacinska, A. Polyethylene film with prolonged thermo-oxidative resistance. International Polymer Science and

Technology. 21(1994): 95-97.

Saleh, J.A., and Elizabeth, L.A. Photooxidative Effects on Properties and

Structure of High-Density Polyethylene. Journal of Apply Polymer

Science. 53(1994): 411-423.

Schnabel, W. Polymer Degradation: Hanser, Munchen Wien, 1981.

Sebaa, M. Servens, C., and Pouyet, J. Natural and Artificial Weathering of

Low-Density Polyethylene (LDPE): Calometric Analysis. Journal of

Apply Polymer Science. 45(1992): 1049-1053.

Sperling, L.H. Introduction to physical polymer science, John Wiley & Sons

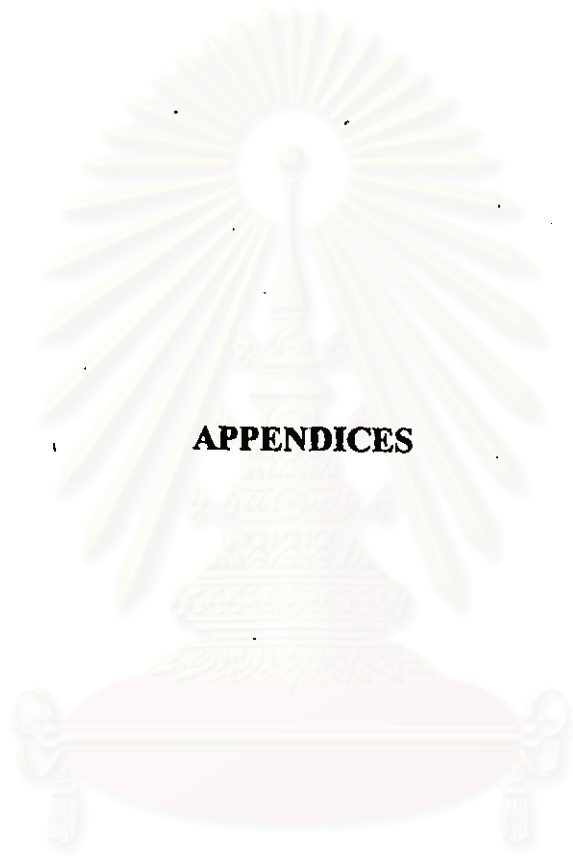
Inc., Singapore: 1993.

Stephen, L.R. Fundamental Principle of Polymeric Materials, New York : John

Wiley & Sons, Inc., 1993.

Tadjani, A., Arnaud, R., and Dasilva, A. Natural and Accelerated Photoaging of Linear Low Density Polyethylene: Changes of the Elongation at

Break. Journal of Applied Polymer Science 47(1993): 211-216.



APPENDICES

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย



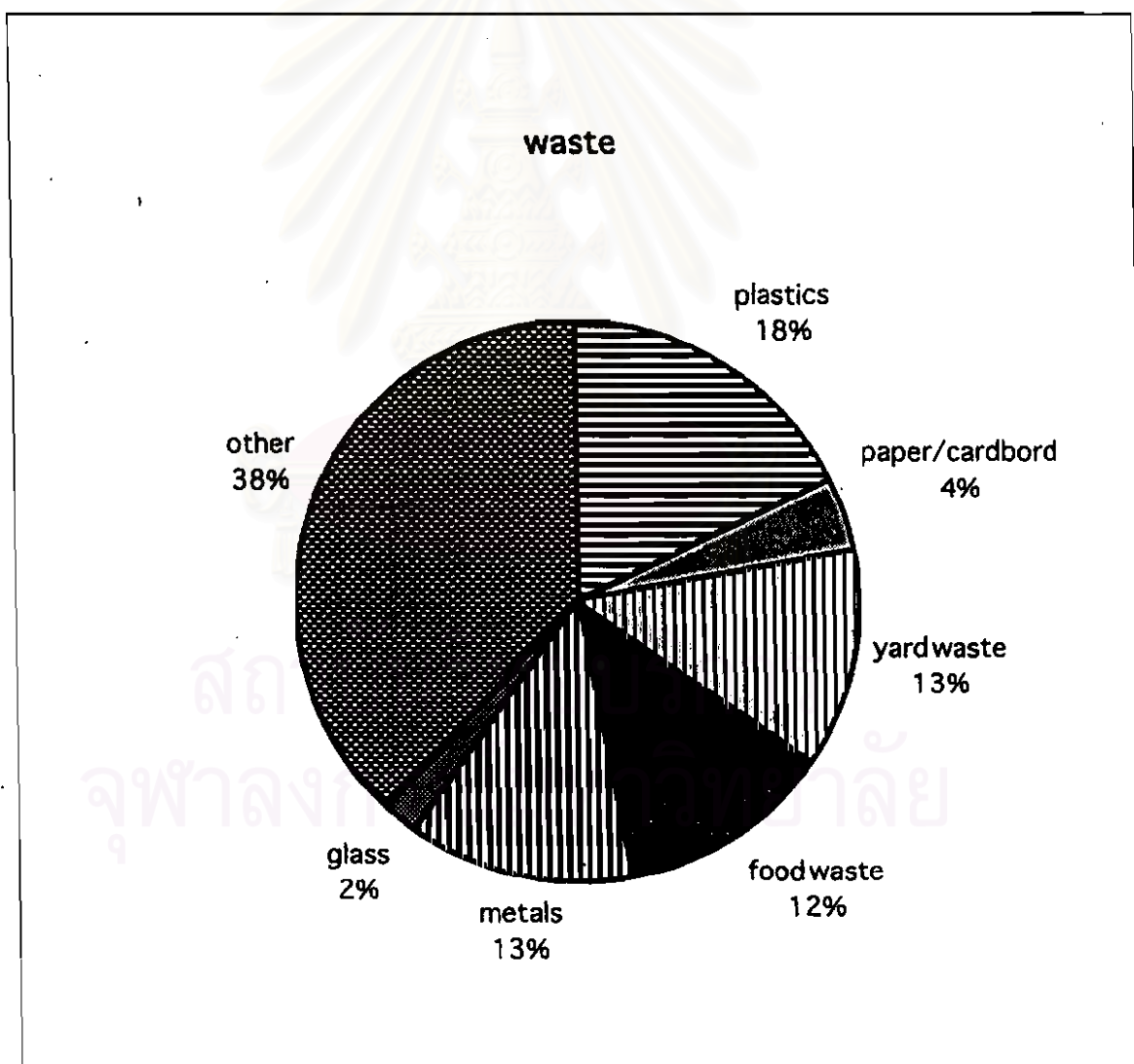
Appendix A

**Data distribution of product categories in the wastestream % by volume
and % plastics in packaging (Degradable Plastic, 1992)**

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

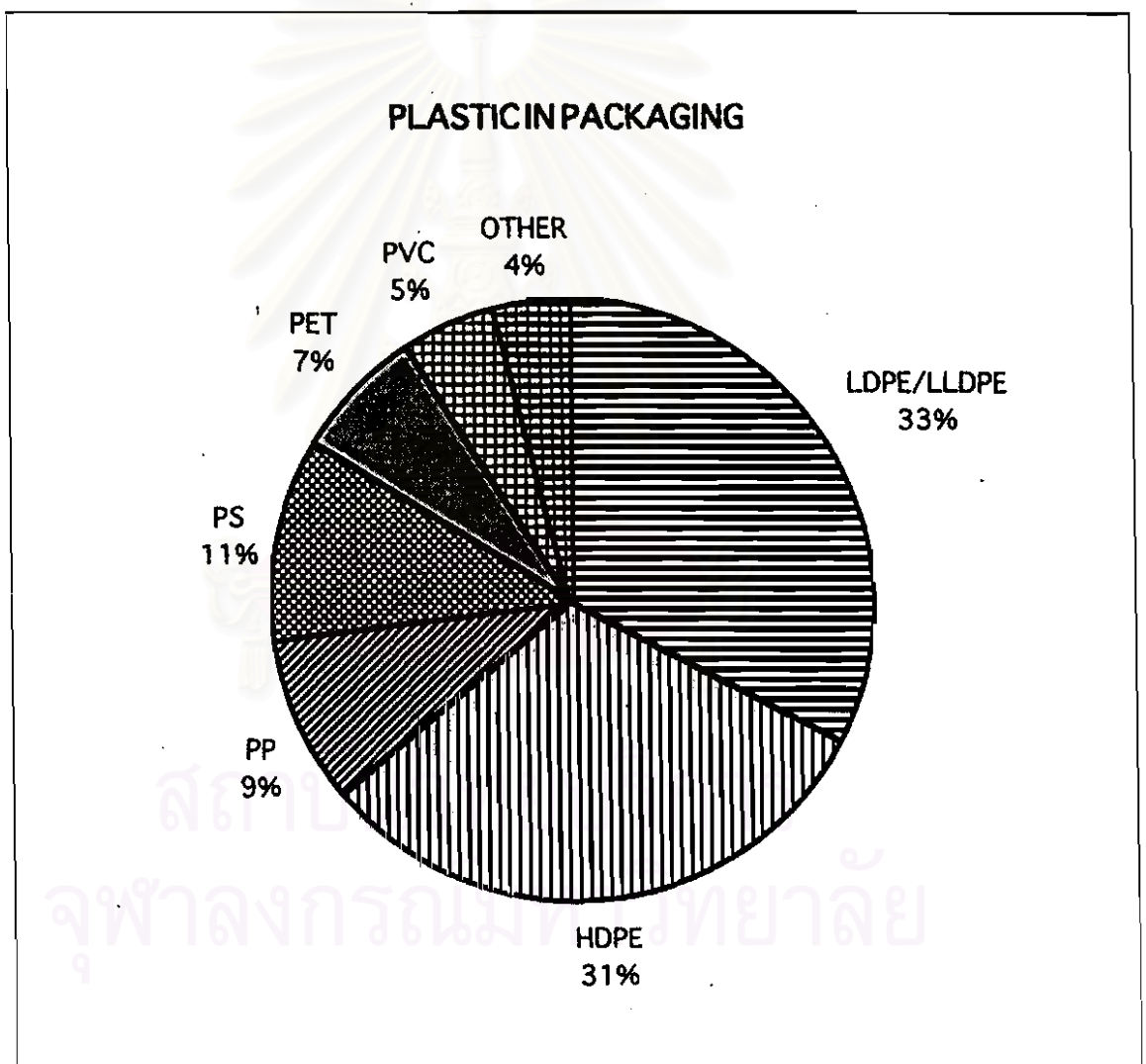
Distribution of product categories in the wastestream % by volume

plastics	18%
paper/cardbord	4%
yard waste	13%
food waste	12%
metals	13%
glass	2%
other	38%



% Plastic in packaging

LDPE/LLDPE	33%
HDPE	31%
PP	9%
PS	11%
PET	7%
PVC	5%
OTHER	4%





Appendix B

Raw data for chemical properties of PP, HDPE and LDPE respectively.

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Table B1 Changes in the chemical properties of PP films in response to various exposure times

Nature exposure time (weeks)	Xenotest exposure time (hours)	Carbonyl absorbance 1715 cm ⁻¹		Terminal vinyl absorbance 908 cm ⁻¹	
		Nature	Accelerated UV exposure	Nature	Accelerated UV exposure
0	0	0.0210	0.0210	0.0300	0.0300
1	19	0.0330	0.0732	0.0470	0.0990
2	38	0.0317	0.0970	0.0210	0.0710
3	57	0.0300	0.0980	0.0440	0.0790
4	76	0.0360	0.1098	0.0360	0.0980
5	95	0.0416	0.1384	0.0420	0.1200
6	114	0.0493	0.1210	0.0540	0.0930
7	133	0.0496	0.1710	0.0460	0.1230
8	152	0.0580	0.2930	0.0290	0.1660
9	171	0.1010	0.5110	0.0580	0.2660

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Table B2 Changes in the chemical properties of HDPEfilms
in response to various exposure times

Nature exposure time (weeks)	Carbonyl absorbance 1715 cm ⁻¹	Terminal vinyl absorbance 908 cm ⁻¹
	Nature	Nature
0	0.0230	0.0020
1	0.0400	0.0160
2	0.0430	0.0030
3	0.0361	0.0040
4	0.0280	0.0040
5	0.0360	0.0160
6	0.0440	0.0150
7	0.0330	0.0290
8	0.0380	0.0240
9	0.0440	0.0240
10	0.0320	0.0110
11	0.0490	0.0060
12	0.0482	0.0090
13	0.0564	0.0040
14	0.0620	0.0360
15	0.0660	0.0400
16	0.0630	0.0521
17	0.0680	0.0460
18	0.0710	0.0490
19	0.0810	0.0190
20	0.0560	0.0170
21	0.0660	0.0340
22	0.0780	0.0340
23	0.0660	0.0330

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Continued

Xenotest exposure time (hours)	Carbonyl absorbance 1715 cm ⁻¹	Terminal vinyl absorbance 908 cm ⁻¹
	Accelerated UV exposure	Accelerated UV exposure
0	0.0418	0.0360
76	0.0689	0.0670
152	0.1040	0.0860
228	0.0948	0.0834
304	0.1147	0.0948
380	0.2130	0.1340
456	0.2290	0.1420
532	0.3340	0.2460
608	0.2550	0.2440
684	0.1830	0.1220
760	0.2870	0.2170
836	0.3650	0.2875

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

**Table B3 Changes in the chemical properties of LDPE films
in response to various exposure times**

Nature exposure time (weeks)	Carbonyl absorbance 1715 cm ⁻¹	Terminal vinyl absorbance 908 cm ⁻¹
	Nature	Nature
0	0.0350	0.0440
1	0.0510	0.0530
2	0.0600	0.0370
3	0.0660	0.0600
4	0.1190	0.0540
5	0.0650	0.0790
6	0.0890	0.0520
7	0.1210	0.0670
8	0.1400	0.0870
9	0.2180	0.1030
10	0.2470	0.0930
11	0.2290	0.0854
12	0.2700	0.0990
13	0.4240	0.1840
14	0.4290	0.1550
15	0.2580	0.1280
16	0.3550	0.1430
17	0.3710	0.1490
18	0.3290	0.1310
19	0.5610	0.1910
20	0.3650	0.1340
21	0.5150	0.1900
22	0.4870	0.1670
23	0.5010	0.1700
24	0.5550	0.1950

Continued

Xenotest exposure time (hours)	Carbonyl absorbance 1715 cm ⁻¹	Terminal vinyl absorbance 908 cm ⁻¹
	Accelerated UV exposure	Accelerated UV exposure
0	0.0343	0.0419
76	0.1749	0.1362
152	0.2240	0.1510
228	0.2410	0.1360
304	0.2500	0.1908
380	0.2870	0.1620
456	0.3630	0.1720
532	0.5540	0.2790
608	0.4310	0.2120
684	0.6150	0.3050
760	0.7550	0.4940
836	1.1170	0.8100
912	1.9060	1.2770

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย



Appendix C

Raw data for mechanical properties of PP, HDPE and LDPE respectively.

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Table C1 Changes in the mechanical properties of PP films in response to various exposure times

Nature exposure time (weeks)	Xenotest exposure time (hours)	Sample no.	Elongation at break(%)		Initial modulus (N/mm ²)	
			Nature	Accelerated UV exposure	Nature	Accelerated UV exposure
0	0	1	753.60	753.60	561.73	561.73
		2	681.40	681.40	601.27	601.27
		3	776.70	776.70	579.27	579.27
		4	595.50	595.50	597.56	597.56
		5	669.70	669.70	531.25	531.25
		mean	695.40	695.40	574.22	574.22
		SD	72.17	72.17	28.74	28.74
		RSD	0.10	0.10	0.05	0.05
1	19	1	240.00	564.40	733.62	606.06
		2	279.00	471.60	454.28	535.09
		3	399.00	293.40	704.42	573.29
		4	121.20	524.40	746.61	650.50
		5	109.90	538.20	743.15	621.53
		mean	229.88	478.40	694.67	597.29
		SD	119.71	108.81	125.28	44.56
		RSD	0.52	0.23	0.18	0.07
2	38	1	62.79	567.90	870.87	833.33
		2	88.25	653.30	642.36	711.81
		3	42.58	633.90	650.49	652.78
		4	46.59	494.00	599.25	579.71
		5	43.51	648.30	880.84	558.42
		mean	56.74	599.50	728.76	667.21
		SD	19.42	68.17	135.73	111.00
		RSD	0.34	0.11	0.18	0.17
3	57	1	20.21	564.60	592.78	753.42
		2	24.42	529.40	682.37	592.11
		3	34.73	198.80	643.74	615.96
		4	23.08	536.10	701.22	575.28
		5	49.88	626.60	768.40	602.93
		mean	30.46	491.10	677.74	627.94
		SD	12.16	167.85	65.51	71.71
		RSD	0.40	0.34	0.10	0.11

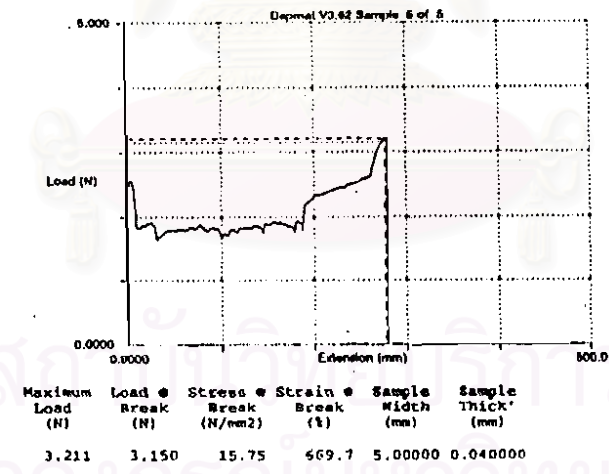
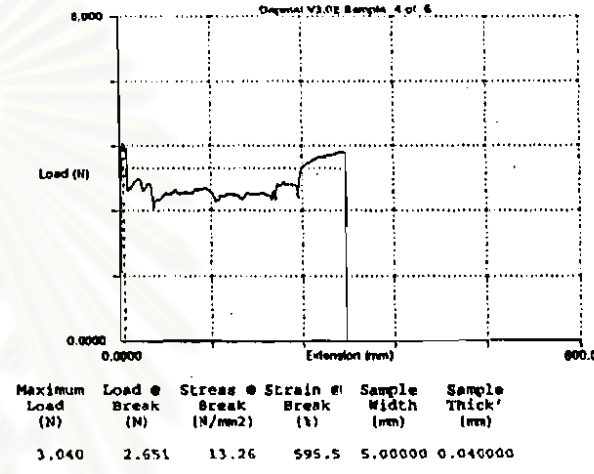
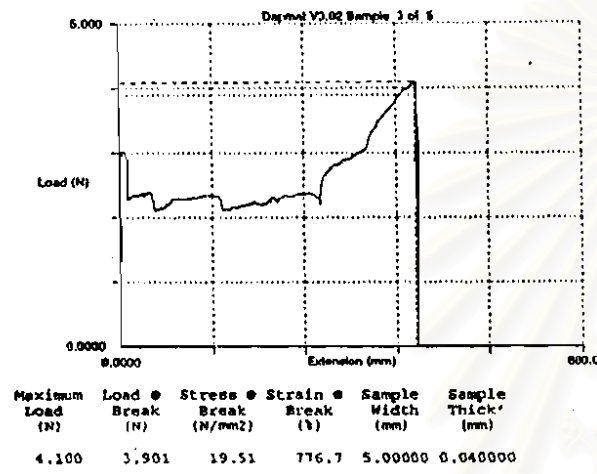
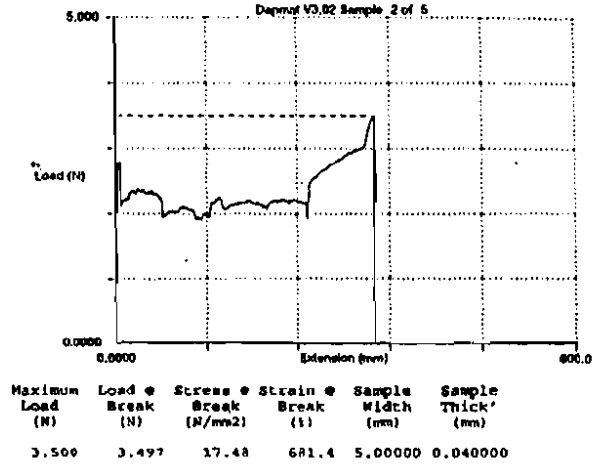
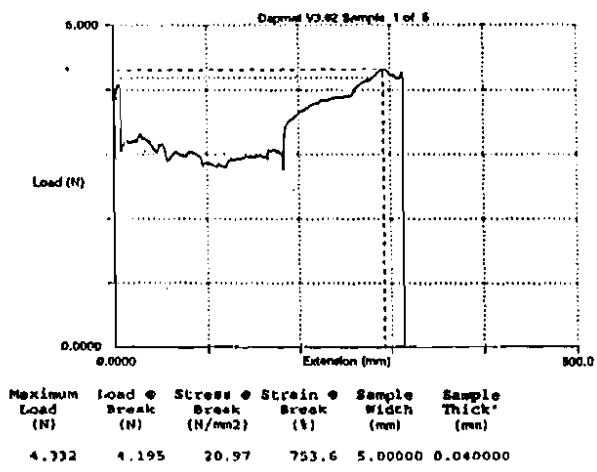
Continued

Nature exposure time (weeks)	Xenotest exposure time (hours)	Sample no.	Elongation at break(%)		Initial modulus (N/mm ²)	
			Nature	Accelerated UV exposure	Nature	Accelerated UV exposure
4	76	1	30.63	61.30	690.24	660.95
		2	38.91	27.41	732.32	726.18
		3	22.48	53.22	783.58	648.20
		4	22.75	16.93	913.46	574.16
		5	20.21	27.68	768.23	722.15
		mean	27.00	37.31	777.57	666.33
		SD	7.74	18.94	84.06	62.35
		RSD	0.29	0.51	0.11	0.10
5	95	1	26.58	28.24	655.63	758.55
		2	24.26	24.28	660.23	932.20
		3	26.33	17.16	851.28	1049.38
		4	30.08	20.21	697.83	1106.90
		5	25.27	27.97	727.56	794.66
		mean	26.50	23.58	718.51	928.33
		SD	2.20	4.85	79.82	152.68
		RSD	0.08	0.20	0.11	0.16
6	114	1	28.26	0.66	595.76	1042.78
		2	17.80	0.91	562.36	1058.80
		3	24.91	0.47	536.31	759.80
		4	27.66	0.77	496.66	1053.92
		5	19.58		557.89	
		mean	23.64	0.56	695.76	978.83
		SD	4.74	0.18	36.54	146.17
		RSD	0.34	0.32	0.18	0.15
7	133	1	22.10	-	835.53	-
		2	24.95	-	835.70	-
		3	20.93	-	693.72	-
		4	26.86	-	763.20	-
		5	23.25	-	772.48	-
		mean	23.62	-	781.00	-
		SD	2.34	-	59.10	-
		RSD	0.10	-	0.08	-

Continued

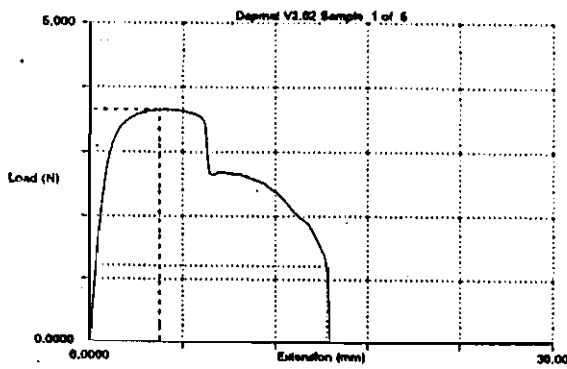
Nature exposure time (weeks)	Xenotest exposure time (hours)	Sample no.	Elongation at break(%)		Initial modulus (N/mm ²)	
			Nature	Accelerated UV exposure	Nature	Accelerated UV exposure
8	152	1	5.47	-	894.70	-
		2	2.78	-	871.79	-
		3	3.40	-	883.19	-
		4	0.72	-	660.88	-
		5	1.64	-	812.31	-
		mean	2.80	-	824.45	-
		SD	1.81	-	96.86	-
		RSD	0.64	-	0.12	-
9	171	1	1.36	-	911.11	-
		2	1.55	-	914.06	-
		3	1.27	-	783.06	-
		4	3.70	-	948.27	-
		5	2.50	-	814.10	-
		mean	1.95	-	874.12	-
		SD	1.03	-	71.34	-
		RSD	0.53	-	0.08	-

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

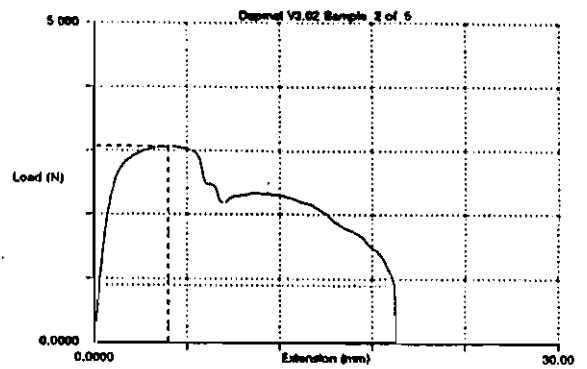


sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	4.332	4.195	20.97	753.6	5.000	0.0400
2	3.500	3.497	17.48	681.4	5.000	0.0400
3	4.100	3.901	19.51	776.7	5.000	0.0400
4	3.040	2.651	13.26	595.5	5.000	0.0400
5	3.211	3.150	15.75	669.7	5.000	0.0400
mean	3.637	3.479	17.39	695.4	5.000	0.0400
standard deviation	0.560	0.609	3.05	72.2	0.000	0.0000

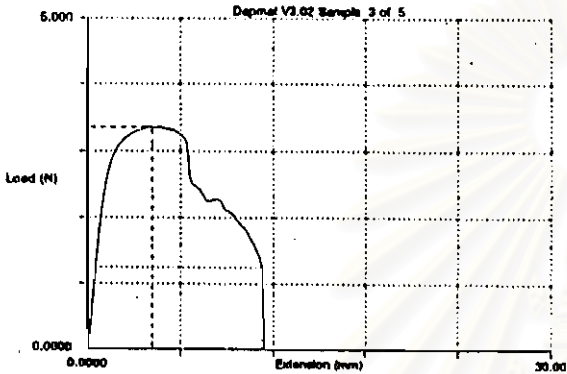
Figure C1 Stress-strain curve of unexposed PP films



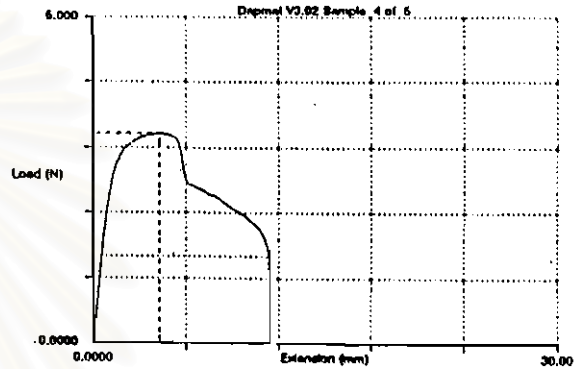
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.669	1.208	6.276	30.63	5.00000	0.038500



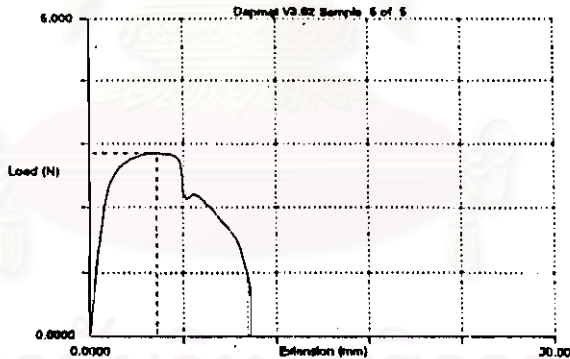
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.070	0.8915	4.692	38.91	5.00000	0.038000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.362	1.245	6.551	22.48	5.00000	0.038000



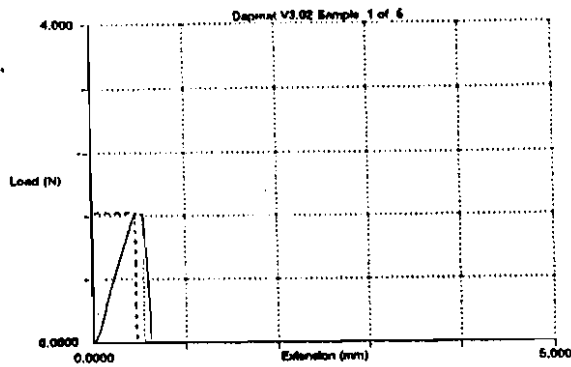
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.213	1.328	6.812	22.75	5.00000	0.039000



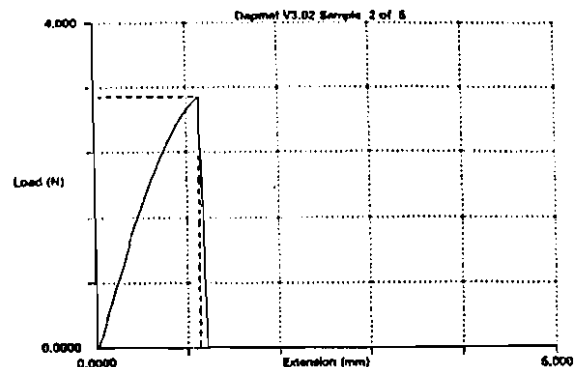
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.857	0.9877	5.131	20.21	5.00000	0.038500

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.669	1.208	6.276	30.63	5.000	0.0385
2	3.070	0.8915	4.692	38.91	5.000	0.0380
3	3.362	1.245	6.551	22.48	5.000	0.0380
4	3.213	1.328	6.812	22.75	5.000	0.0390
5	2.857	0.9877	5.131	20.21	5.000	0.0385
mean	3.234	1.132	5.893	27.00	5.000	0.0384
standard deviation	0.306	0.184	0.928	7.74	0.000	0.0004

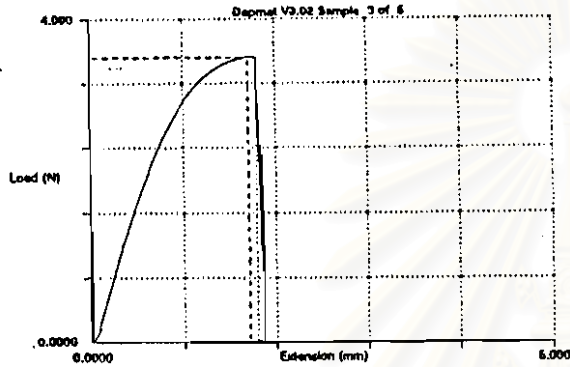
Figure C2 Stress-strain curve of exposure PP films after 3 weeks in outdoor exposure



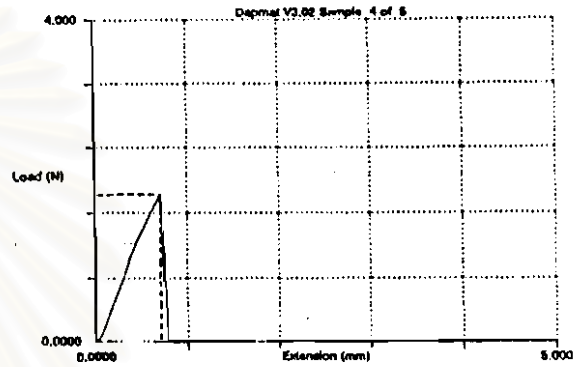
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.642	1.623	8.324	1.098	5.00000	0.039000



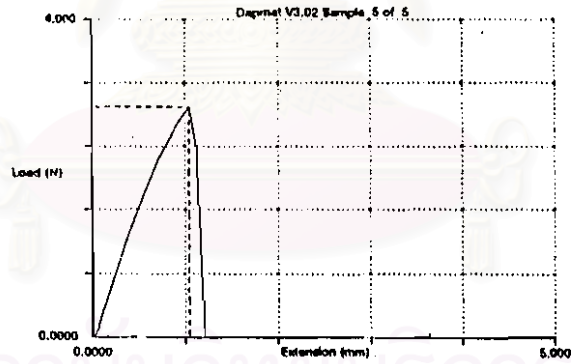
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.085	3.085	15.82	2.269	5.00000	0.039000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.525	3.521	18.06	3.584	5.00000	0.039000



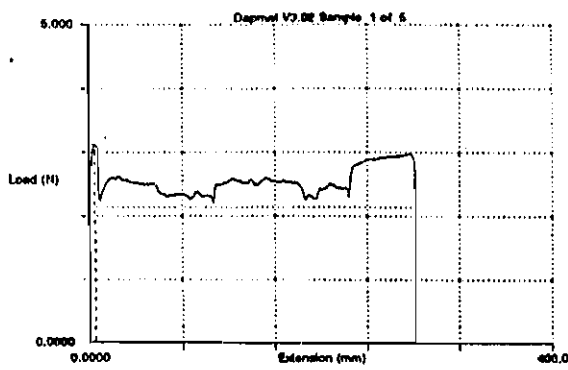
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.828	1.828	9.373	1.420	5.00000	0.039000



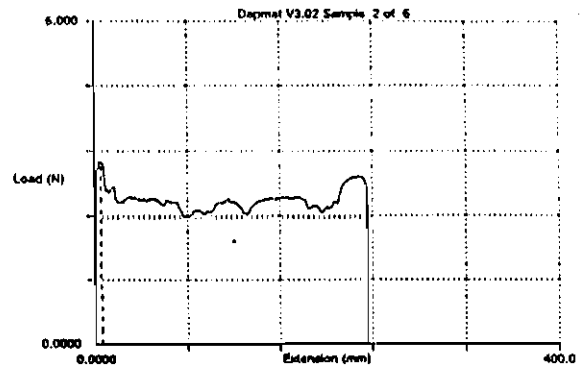
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.901	2.901	14.88	2.086	5.00000	0.039000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	1.642	1.623	8.324	1.098	5.000	0.0390
2	3.085	3.085	15.82	2.269	5.000	0.0390
3	3.525	3.521	18.06	3.584	5.000	0.0390
4	1.828	1.828	9.373	1.420	5.000	0.0390
5	2.901	2.901	14.88	2.086	5.000	0.0390
mean	2.596	2.592	13.29	2.091	5.000	0.0390
standard deviation	0.821	0.825	4.23	0.962	0.000	0.0000

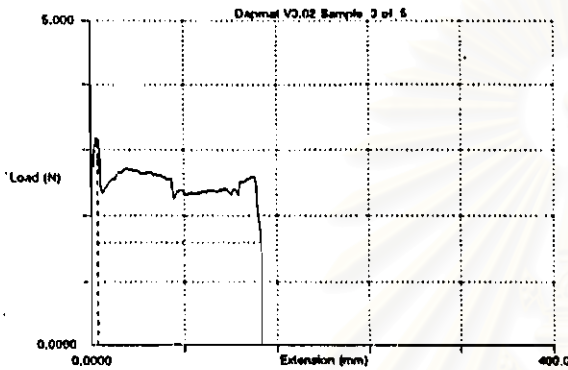
Figure C3 Stress-strain curve of exposure PP films after 8 weeks in outdoor exposure



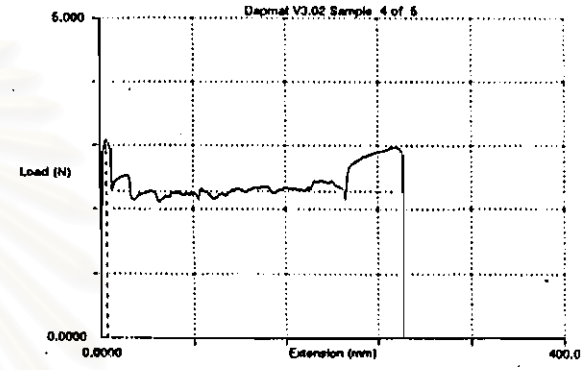
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.124	2.144	14.29	564.4	5.00000	0.030000



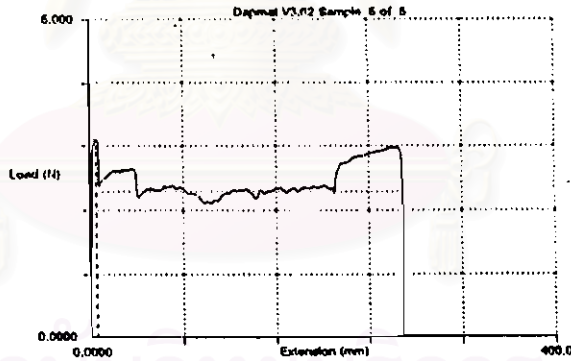
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.837	1.960	13.06	471.6	5.00000	0.030000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.192	1.586	10.23	293.4	5.00000	0.031000



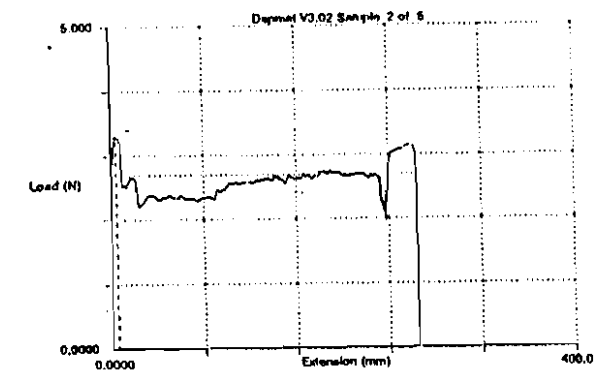
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.086	2.281	14.71	524.4	5.00000	0.031000



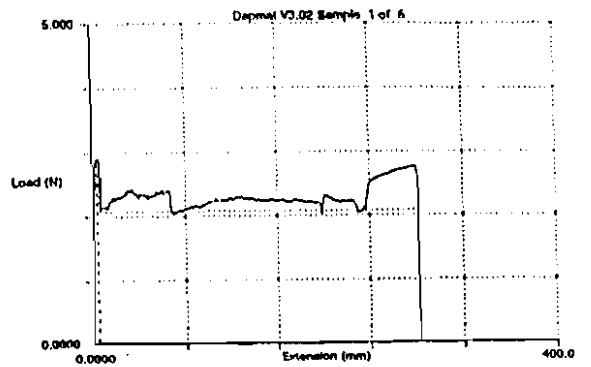
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.099	2.290	14.77	538.2	5.00000	0.031000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.124	2.144	14.29	564.4	5.000	0.0300
2	2.837	1.960	13.06	471.6	5.000	0.0300
3	3.192	1.586	10.23	293.4	5.000	0.0310
4	3.086	2.281	14.71	524.4	5.000	0.0310
5	3.099	2.290	14.77	538.2	5.000	0.0310
mean	3.068	2.052	13.42	478.4	5.000	0.0306
standard deviation	0.135	0.293	1.91	108.8	0.000	0.0005

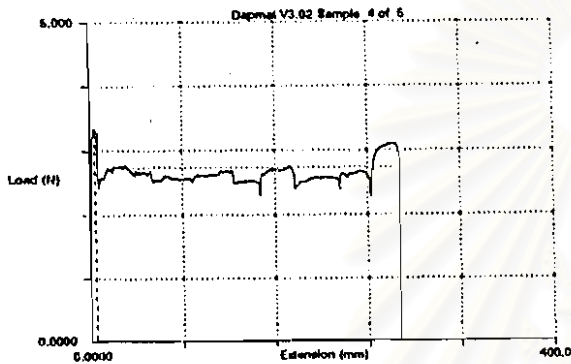
Figure C4 Stress-strain curve of PP films after 57 hours in Xenotest



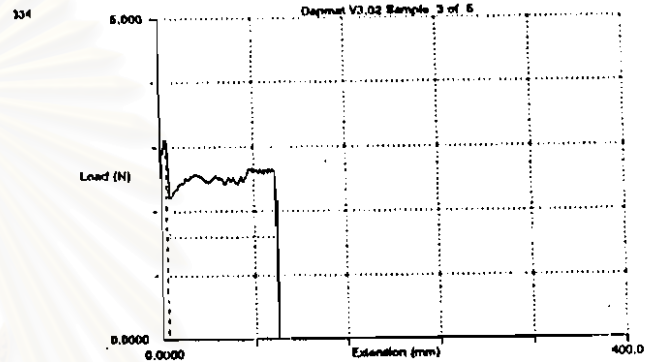
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.303	2.700	13.50	529.4	5.00000	0.040000



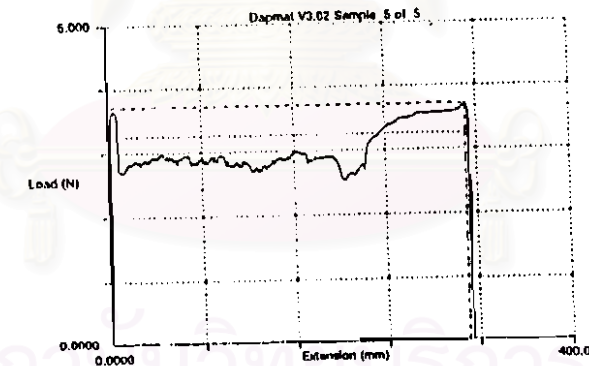
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.912	2.077	10.38	564.6	5.00000	0.040000



Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.355	2.737	13.68	536.1	5.00000	0.040000



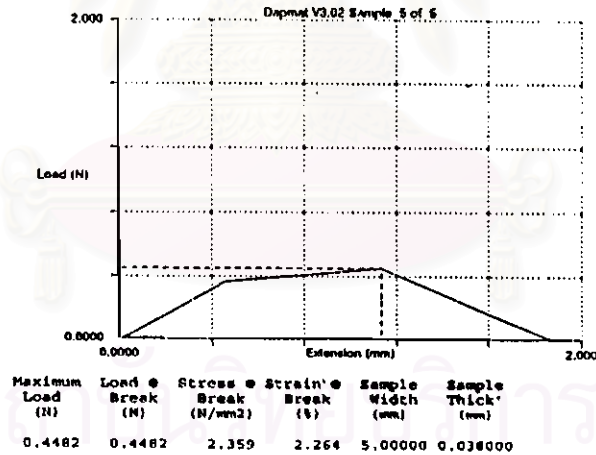
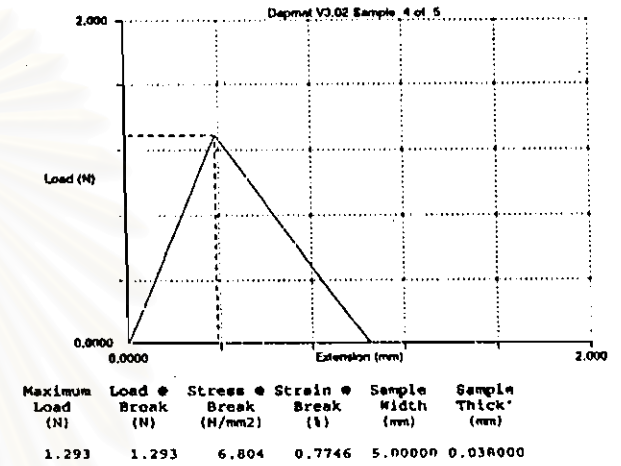
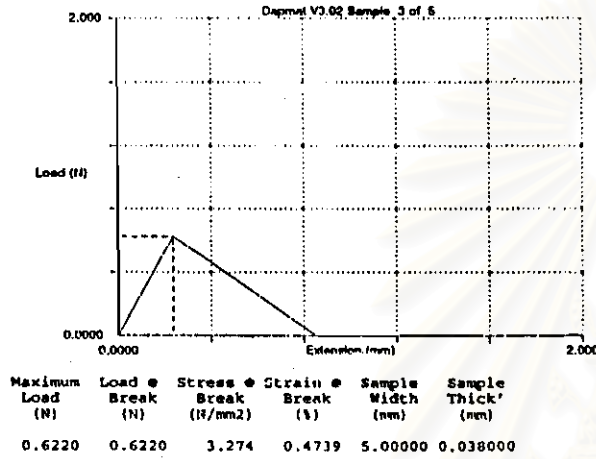
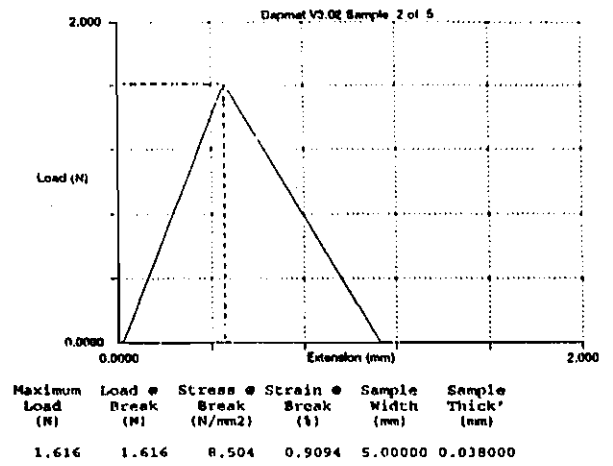
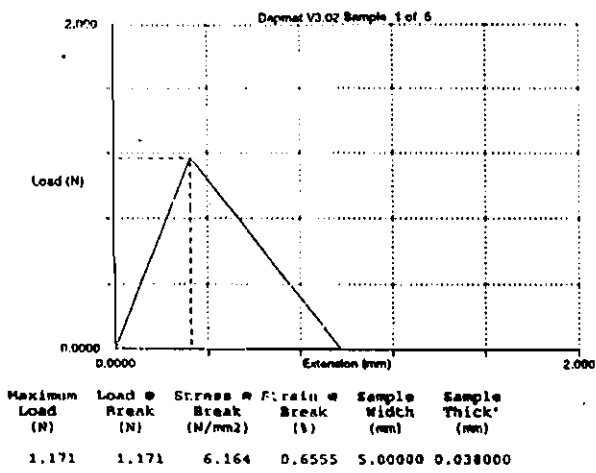
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.123	1.585	7.926	198.8	5.00000	0.040000



Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.717	3.259	16.29	626.6	5.00000	0.040000

sample	Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	2.912	2.077	10.38	564.6	5.000	0.0400
2	3.303	2.700	13.50	529.4	5.000	0.0400
3	3.123	1.585	7.926	198.8	5.000	0.0400
4	3.355	2.737	13.68	536.1	5.000	0.0400
5	3.717	3.259	16.29	626.6	5.000	0.0400
mean	3.282	2.472	12.36	491.1	5.000	0.0400
standard deviation	0.299	0.649	3.24	167.8	0.000	0.0000

Figure C5 Stress-strain curve of exposure PP films after 76 hours in xenotest exposure



sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	1.171	1.171	6.164	0.6555	5.000	0.0380
2	1.616	1.616	8.504	0.9094	5.000	0.0380
3	0.6220	0.6220	3.274	0.4739	5.000	0.0380
4	1.293	1.293	6.804	0.7746	5.000	0.0380
5	0.4482	0.4482	2.359	2.264	5.000	0.0380
mean	1.030	1.030	5.421	1.016	5.000	0.0380
standard deviation	0.484	0.484	2.547	0.716	0.000	0.0000

Figure C6 Stress-strain curve of PP films after 114 hours in Xenotest

Table C2 Changes in the mechanical properties of HDPE films
in response to various exposure times

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
0	1	294.30	1006.99
	2	222.40	953.49
	3	286.90	930.85
	4	281.70	861.11
	5	294.50	887.42
	mean	276	927.97
	SD	30.42	57.05
	RSD	0.11	0.06
1	1	165.33	778.85
	2	174.40	750.00
	3	175.00	864.66
	4	182.90	662.34
	5	154.70	700.64
	mean	170.50	751.30
	SD	10.79	77.61
	RSD	0.06	0.10
2	1	183.00	809.52
	2	168.30	718.31
	3	165.50	709.22
	4	152.50	628.57
	5	170.00	991.30
	mean	169.50	771.38
	SD	10.90	138.65
	RSD	0.06	0.18
3	1	123.00	991.30
	2	154.50	944.44
	3	165.30	990.38
	4	133.00	948.72
	5	141.10	1040.00
	mean	131.40	982.97
	SD	16.83	38.84
	RSD	0.12	0.04

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
4	1	155.00	1056.60
	2	131.00	1053.26
	3	169.70	1000.00
	4	156.60	933.96
	5	143.10	843.48
	mean	151.1	977.46
	SD	14.66	89.94
	RSD	0.10	0.09
5	1	216.80	1019.61
	2	287.60	872.55
	3	171.40	882.35
	4	235.40	850.88
	5	175.10	936.84
	mean	217.30	912.45
	SD	47.85	67.76
	RSD	0.22	0.07
6	1	148.50	900.00
	2	142.10	990.91
	3	89.61	941.22
	4	125.00	998.11
	5	144.50	1060.00
	mean	137.10	978.05
	SD	24.27	60.69
	RSD	0.18	0.06
7	1	184.10	918.18
	2	164.60	761.90
	3	141.20	935.78
	4	122.80	885.96
	5	155.60	607.50
	mean	153.70	821.86
	SD	23.23	137.76
	RSD	0.15	0.17

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
8	1	137.30	1000.63
	2	124.70	1125.43
	3	114.60	997.35
	4	163.60	987.83
	5	133.60	978.30
	mean	134.8	1017.91
	SD	18.35	60.74
	RSD	0.14	0.06
9	1	103.70	1157.41
	2	115.80	852.71
	3	124.50	1009.52
	4	110.70	885.25
	5	172.80	811.32
	mean	125.50	943.24
	SD	27.51	140.73
	RSD	0.22	0.15
10	1	139.80	859.77
	2	107.20	930.43
	3	125.30	894.51
	4	143.20	979.95
	5	129.80	1091.59
	mean	129.10	951.05
	SD	14.21	90.19
	RSD	0.11	0.09
11	1	170.40	994.59
	2	117.10	940.54
	3	128.10	1066.67
	4	145.60	918.52
	5	140.20	1352.38
	mean	140.30	1054.54
	SD	20.13	176.03
	RSD	0.14	0.17

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
12	1	110.20	1297.82
	2	101.30	1207.15
	3	79.91	1185.53
	4	96.34	1150.45
	5	104.20	1116.86
	mean	98.37	1191.56
	SD	11.48	68.63
	RSD	0.12	0.06
13	1	111.60	1004.12
	2	119.00	1062.39
	3	128.20	1141.18
	4	100.70	978.76
	5	138.20	938.46
	mean	119.50	1024.98
	SD	14.50	78.99
	RSD	0.12	0.08
14	1	132.80	1206.98
	2	104.90	1045.51
	3	123.00	1095.18
	4	184.00	1124.32
	5	132.00	1107.23
	mean	135.30	1115.76
	SD	29.43	58.79
	RSD	0.22	0.05
15	1	92.19	1473.68
	2	89.47	1404.96
	3	66.49	1526.32
	4	54.08	1489.36
	5	69.02	1542.55
	mean	74.25	1487.37
	SD	16.19	53.72
	RSD	0.22	0.04

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
16	1	52.02	1266.67
	2	63.27	1210.47
	3	56.43	1361.54
	4	78.09	1374.36
	5	73.94	1258.97
	mean	64.75	1304.40
	SD	11.13	70.66
	RSD	0.17	0.05
17	1	96.07	1291.77
	2	27.04	1457.77
	3	28.87	1416.22
	4	55.59	1397.60
	5	79.83	1456.74
	mean	57.48	1404.02
	SD	30.57	67.93
	RSD	0.53	0.05
18	1	86.25	1480.73
	2	22.89	1438.10
	3	15.55	1431.86
	4	23.80	1462.39
	5	21.14	1315.69
	mean	33.93	1425.75
	SD	29.42	64.55
	RSD	0.86	0.05
19	1	12.43	1322.89
	2	24.75	1468.42
	3	34.08	1455.42
	4	27.33	1043.04
	5	25.74	1286.75
	mean	24.87	1383.37
	SD	7.85	171.81
	RSD	0.32	0.13

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
20	1	16.88	1514.66
	2	27.72	1497.93
	3	26.73	1431.04
	4	49.97	1619.67
	5	42.25	1595.48
	mean	42.25	1531.76
	SD	13.23	76.44
	RSD	0.31	0.05
21	1	4.46	1693.07
	2	6.37	1891.89
	3	6.03	1666.67
	4	6.29	1728.57
	5	4.63	1871.43
	mean	5.56	1770.33
	SD	0.93	104.23
	RSD	0.17	0.06
22	1	11.40	1653.33
	2	12.23	1415.93
	3	8.15	1487.18
	4	12.22	1581.08
	5	7.13	1657.14
	mean	10.23	1558.93
	SD	2.41	105.65
	RSD	0.24	0.07
23	1	1760.80	201.18
	2	1719.76	153.85
	3	1586.06	145.60
	4	1579.07	182.69
	5	1635.63	204.14
	mean	1656.28	177.49
	SD	81.04	26.81
	RSD	0.05	0.15

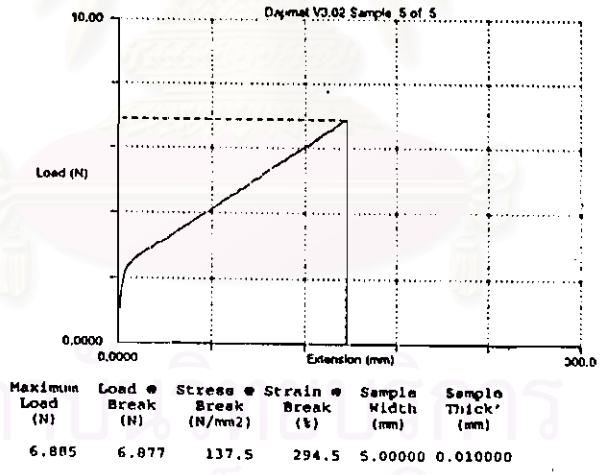
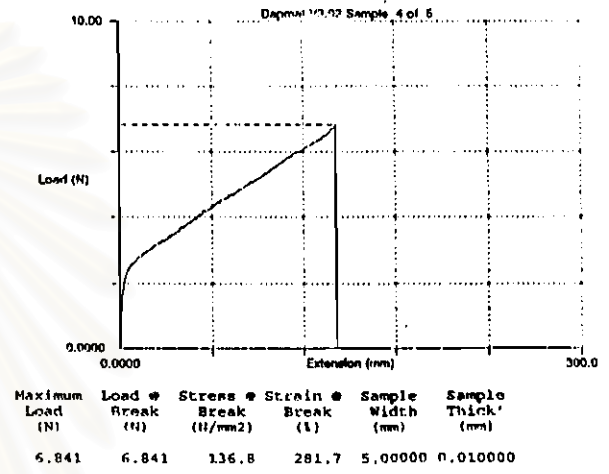
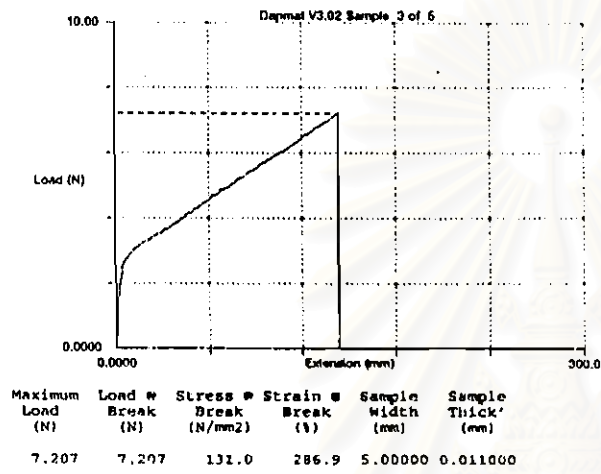
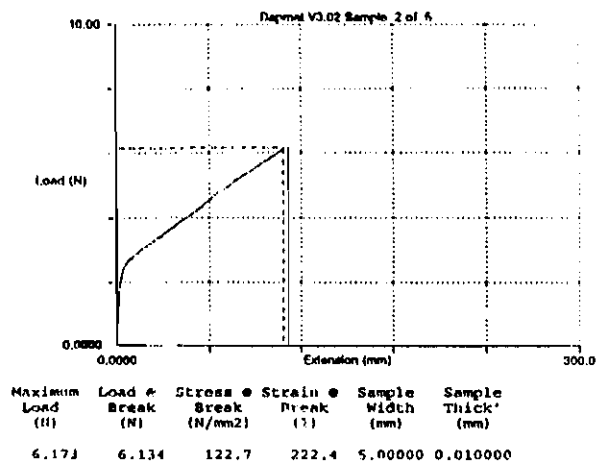
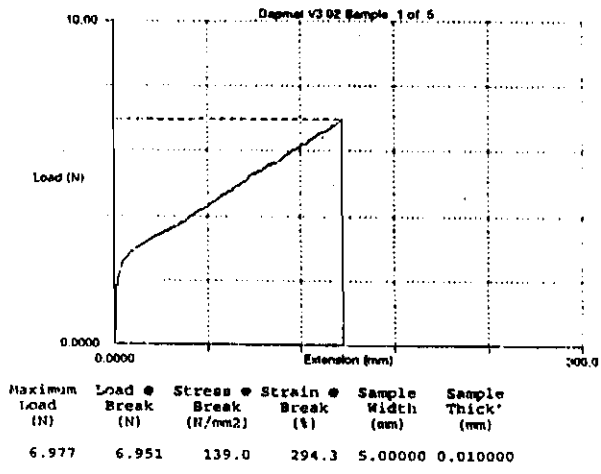
Continued (Accelerated UV exposure)

Xenotest exposure time (hours)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Accelerated UV exposure	Accelerated UV exposure
0	1	294.30	1006.99
	2	222.40	953.49
	3	286.90	930.85
	4	281.70	861.11
	5	294.50	887.42
	mean	276.00	927.97
	SD	30.42	57.05
	RSD	0.11	0.06
76	1	224.20	794.87
	2	286.60	893.62
	3	227.10	807.02
	4	201.60	710.53
	5	167.00	825.69
	mean	221.30	806.34
	SD	43.71	65.77
	RSD	0.20	0.08
152	1	137.10	927.93
	2	149.20	844.83
	3	179.10	901.79
	4	188.30	814.52
	5	182.30	822.58
	mean	167.20	862.33
	SD	22.61	50.08
	RSD	0.15	0.06
228	1	84.78	1050.85
	2	62.30	1033.90
	3	58.05	1200.00
	4	102.90	1226.42
	5	78.67	1136.36
	mean	77.32	1129.51
	SD	18.09	86.22
	RSD	0.23	0.08

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Accelerated UV exposure	Accelerated UV exposure
304	1	27.67	1459.46
	2	30.73	1535.09
	3	55.89	1401.87
	4	63.65	1468.47
	5	63.56	1530.62
	mean	48.3	1479.10
	SD	17.75	55.35
	RSD	0.37	0.04
380	1	36.96	1296.00
	2	32.30	1393.16
	3	23.31	1632.48
	4	48.63	1697.23
	5	38.37	1603.31
	mean	35.91	1524.44
	SD	9.23	171.15
	RSD	0.26	0.11
456	1	15.72	1318.58
	2	7.89	1295.92
	3	23.37	1479.34
	4	24.64	1354.55
	5	11.31	1324.79
	mean	16.59	1354.64
	SD	7.33	72.78
	RSD	0.44	0.05
532	1	5.33	1620.00
	2	0.97	1551.02
	3	1.11	1446.43
	4	2.03	1435.64
	5	0.97	1428.57
	mean	2.08	1496.33
	SD	1.87	85.22
	RSD	0.90	0.06

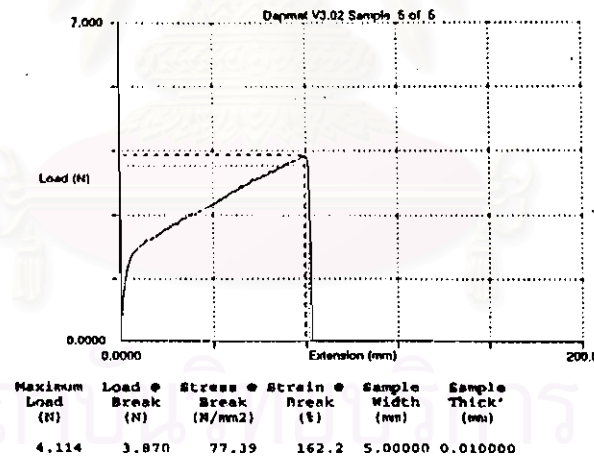
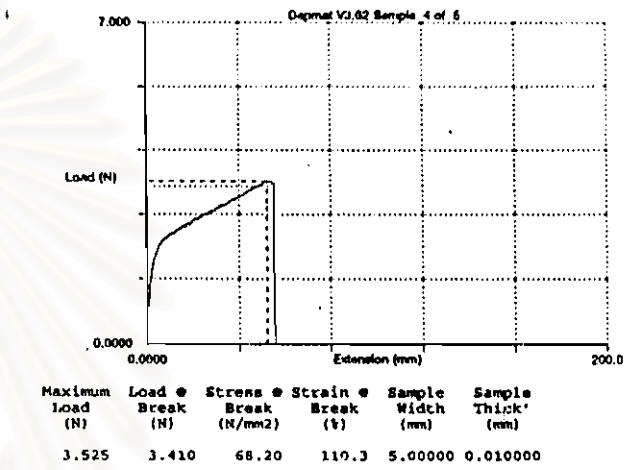
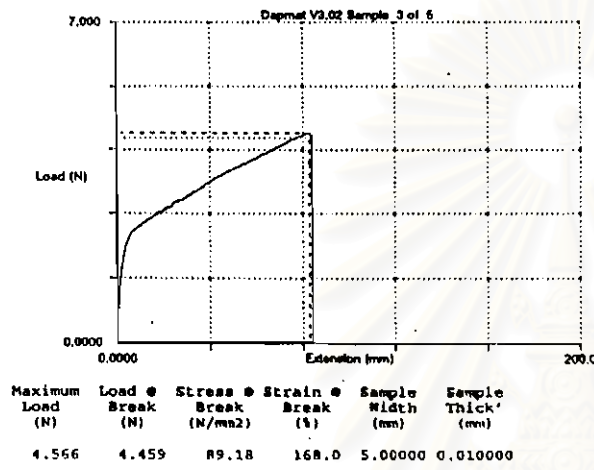
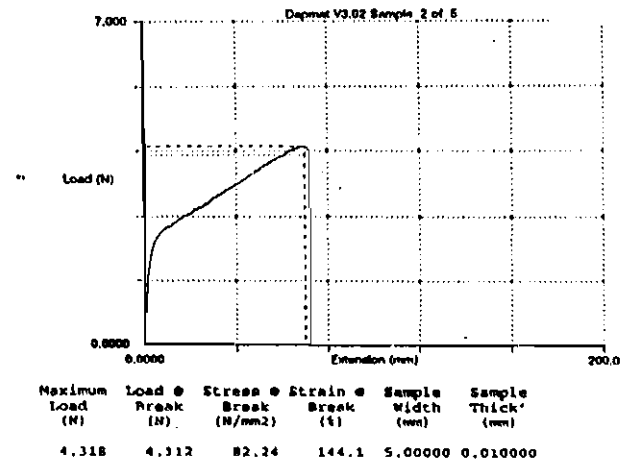
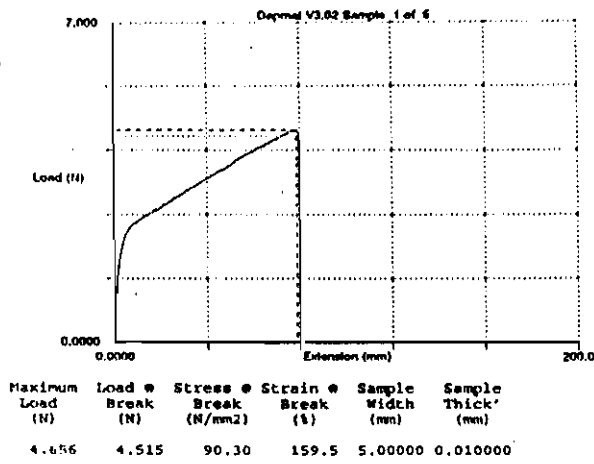
Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Accelerated UV exposure	Accelerated UV exposure
608	1	3.81	1730.77
	2	1.04	1769.23
	3	1.04	1530.61
	4	0.79	1666.67
	5	0.77	1846.15
	mean	1.487	1708.69
	SD	1.30	118.88
	RSD	0.09	0.07
684	1	1.77	1471.91
	2	0.90	1488.89
	3	0.78	1589.74
	4	0.98	1653.06
	5	0.09	1243.90
	mean	1.06	1489.50
	SD	0.60	156.07
	RSD	0.57	0.10

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย



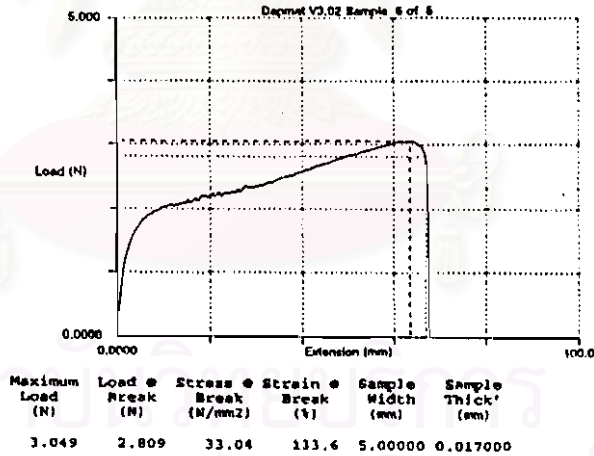
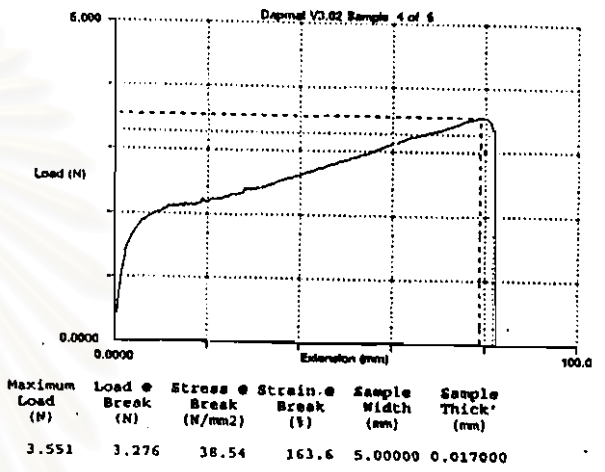
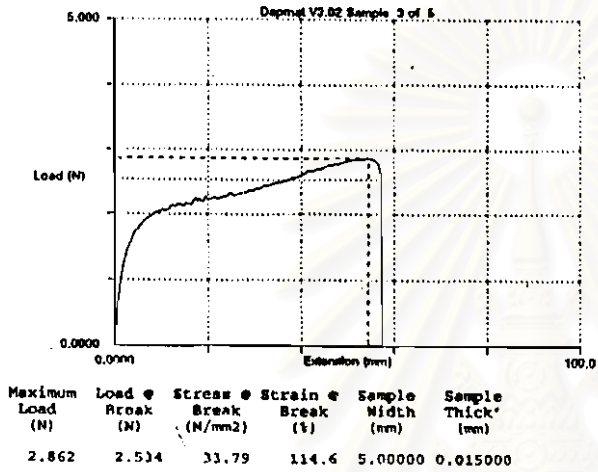
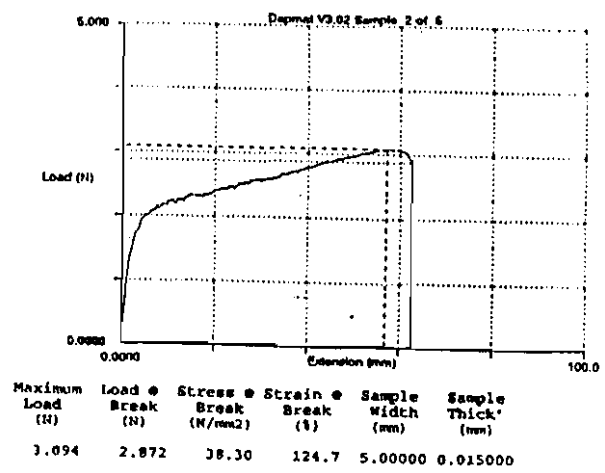
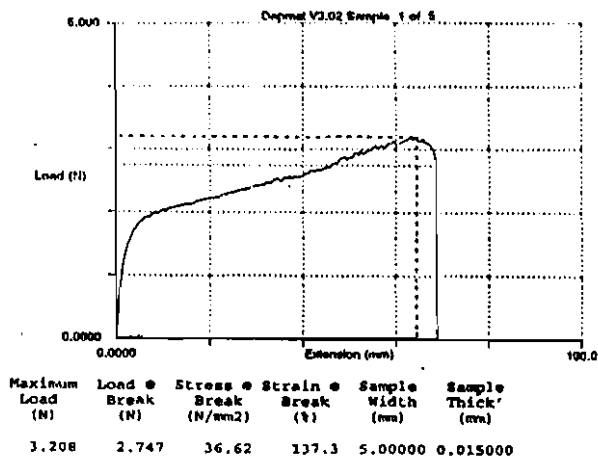
sample	Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	6.977	6.951	139.0	294.3	5.000	0.0100
2	6.173	6.134	122.7	222.4	5.000	0.0100
3	7.207	7.207	131.0	286.9	5.000	0.0110
4	6.841	6.841	136.8	281.7	5.000	0.0100
5	6.885	6.877	137.5	294.5	5.000	0.0100
mean	6.817	6.802	133.4	276.0	107.0	2.006
standard deviation	0.387	0.400	6.7	30.4	140.7	2.733

Figure C7 Stress-strain curve of unexposed HDPE films



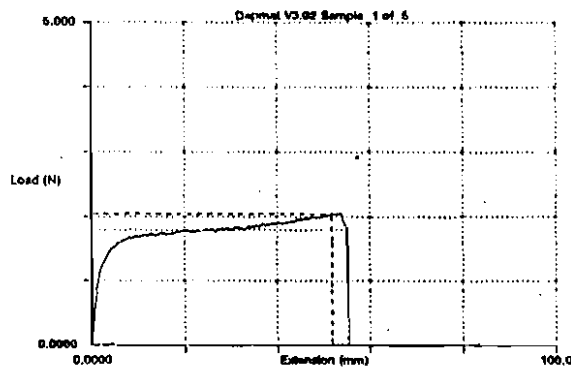
sample	Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	4.656	4.515	90.30	159.5	5.000	0.0100
2	4.318	4.112	82.24	144.1	5.000	0.0100
3	4.566	4.459	89.18	168.0	5.000	0.0100
4	3.525	3.410	68.20	110.3	5.000	0.0100
5	4.114	3.870	77.39	162.2	5.000	0.0100
mean	4.236	4.073	81.46	148.8	5.000	0.0100
standard deviation	0.451	0.455	9.09	23.2	0.000	0.0000

Figure C8 Stress-strain curve of HDPE films after 4 weeks in outdoor exposure

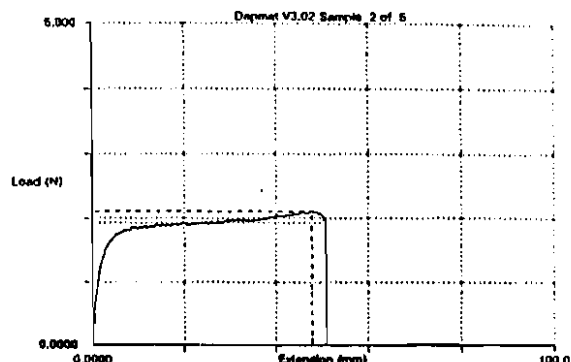


sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.208	2.747	36.62	137.3	5.000	0.0150
2	3.094	2.872	38.30	124.7	5.000	0.0150
3	2.862	2.534	33.79	114.6	5.000	0.0150
4	3.551	3.276	38.54	163.6	5.000	0.0170
5	3.049	2.809	33.04	133.6	5.000	0.0170
mean	3.153	2.848	36.06	134.8	5.000	0.0158
standard deviation	0.255	0.271	2.54	18.4	0.000	0.0011

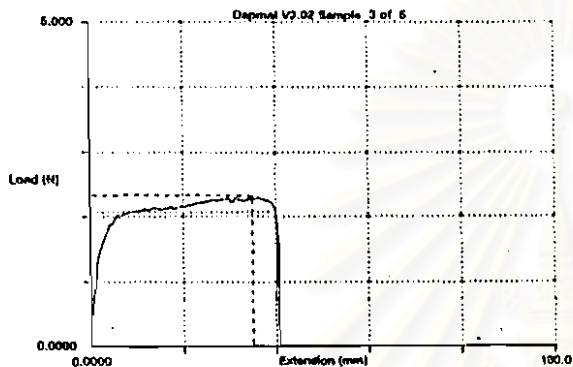
Figure C9 Stress-strain curve of HDPE films after 8 weeks in outdoor exposure



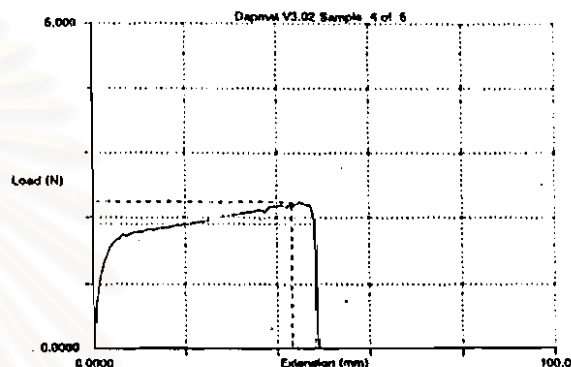
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.044	1.792	32.59	110.2	5.00000	0.011800



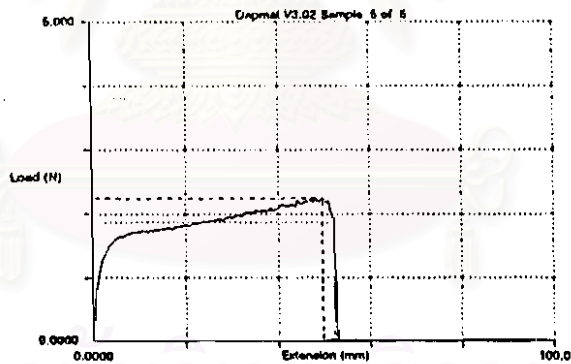
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.104	1.920	34.92	101.3	5.00000	0.011000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.325	2.069	34.49	79.91	5.00000	0.012000



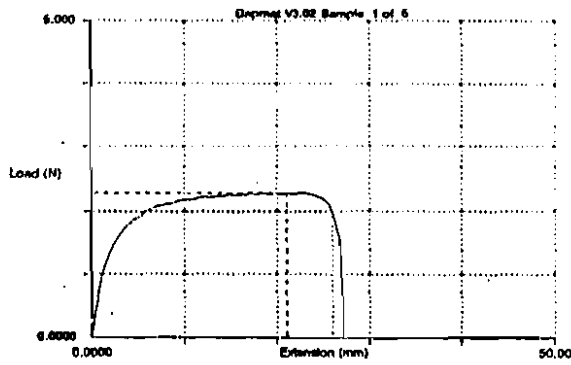
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.241	1.905	27.22	96.34	5.00000	0.014000



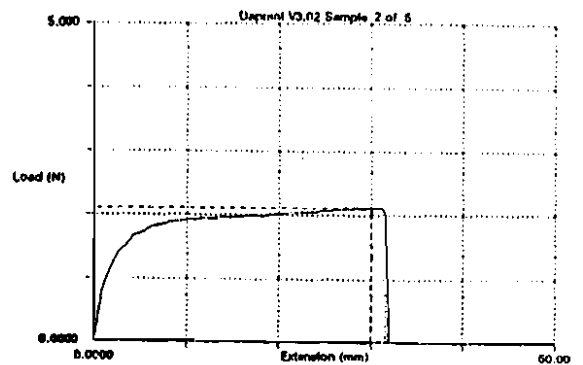
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.246	1.868	31.14	104.2	5.00000	0.012000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.507	2.714	7.237	110.5	5.000	0.0750
2	3.739	2.884	7.796	111.1	5.000	0.0740
3	3.207	2.501	7.467	114.7	5.000	0.0670
4	3.444	2.620	7.381	106.9	5.000	0.0710
5	3.254	2.678	7.544	104.1	5.000	0.0710
mean	3.430	2.680	7.485	109.5	5.000	0.0716
standard deviation	0.213	0.140	0.208	4.1	0.000	0.0031

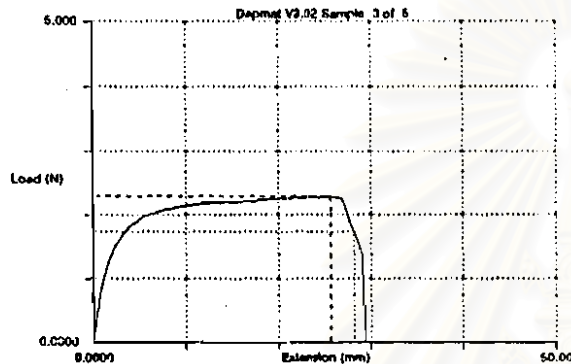
Figure C10 Stress-strain curve of HDPE films after 12 weeks in outdoor exposure



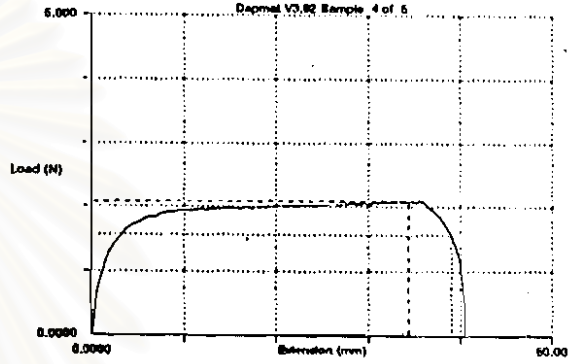
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.282	1.981	33.01	52.02	5.00000	0.012000



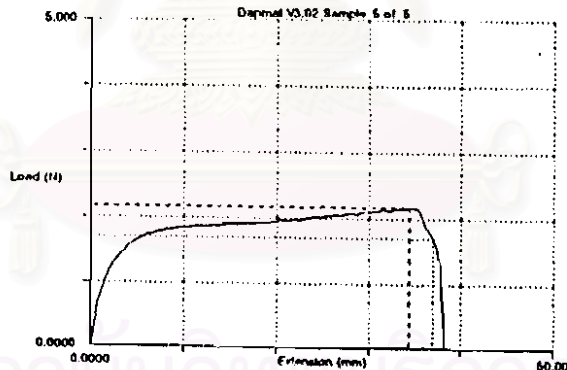
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.116	1.990	33.17	63.27	5.00000	0.012000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.297	1.721	28.68	56.43	5.00000	0.012000



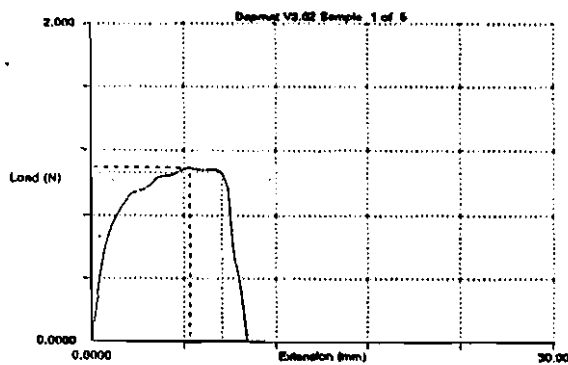
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.087	1.564	26.07	78.09	5.00000	0.012000



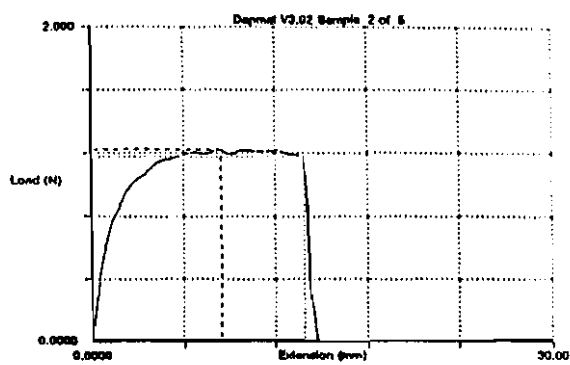
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.168	1.707	31.03	73.94	5.00000	0.011000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	2.282	1.981	33.01	52.02	5.000	0.0120
2	2.116	1.990	33.17	63.27	5.000	0.0120
3	2.297	1.721	28.68	56.43	5.000	0.0120
4	2.087	1.564	26.07	78.09	5.000	0.0120
5	2.168	1.707	31.03	73.94	5.000	0.0110
mean	2.190	1.792	30.39	64.75	5.000	0.0118
standard deviation	0.096	0.187	3.03	11.13	0.000	0.0004

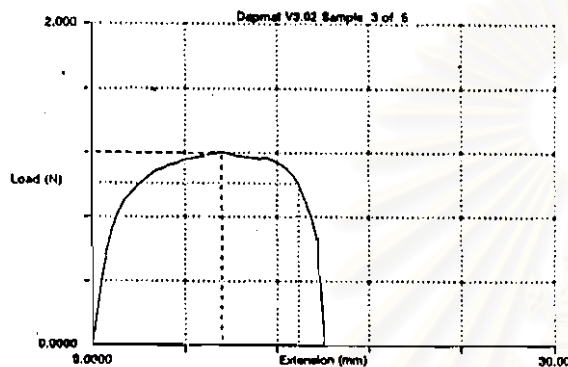
Figure C11 Stress-strain curve of HDPE films after 16 weeks in outdoor exposure



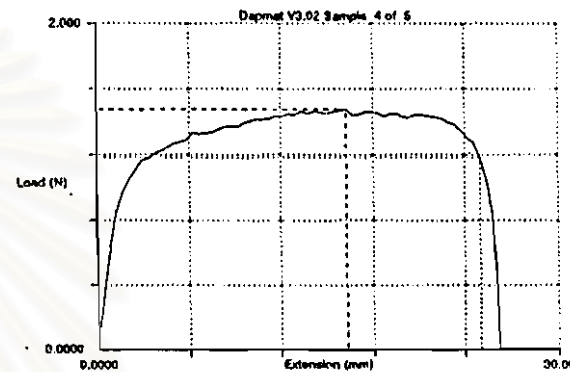
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.094	1.064	19.34	16.88	5.00000	0.011000



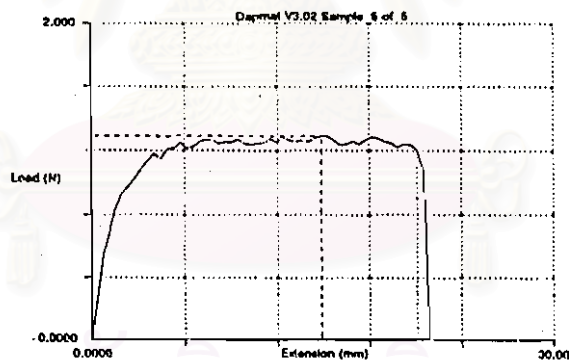
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.225	1.176	21.37	27.72	5.00000	0.011000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.202	1.011	18.39	26.73	5.00000	0.011000



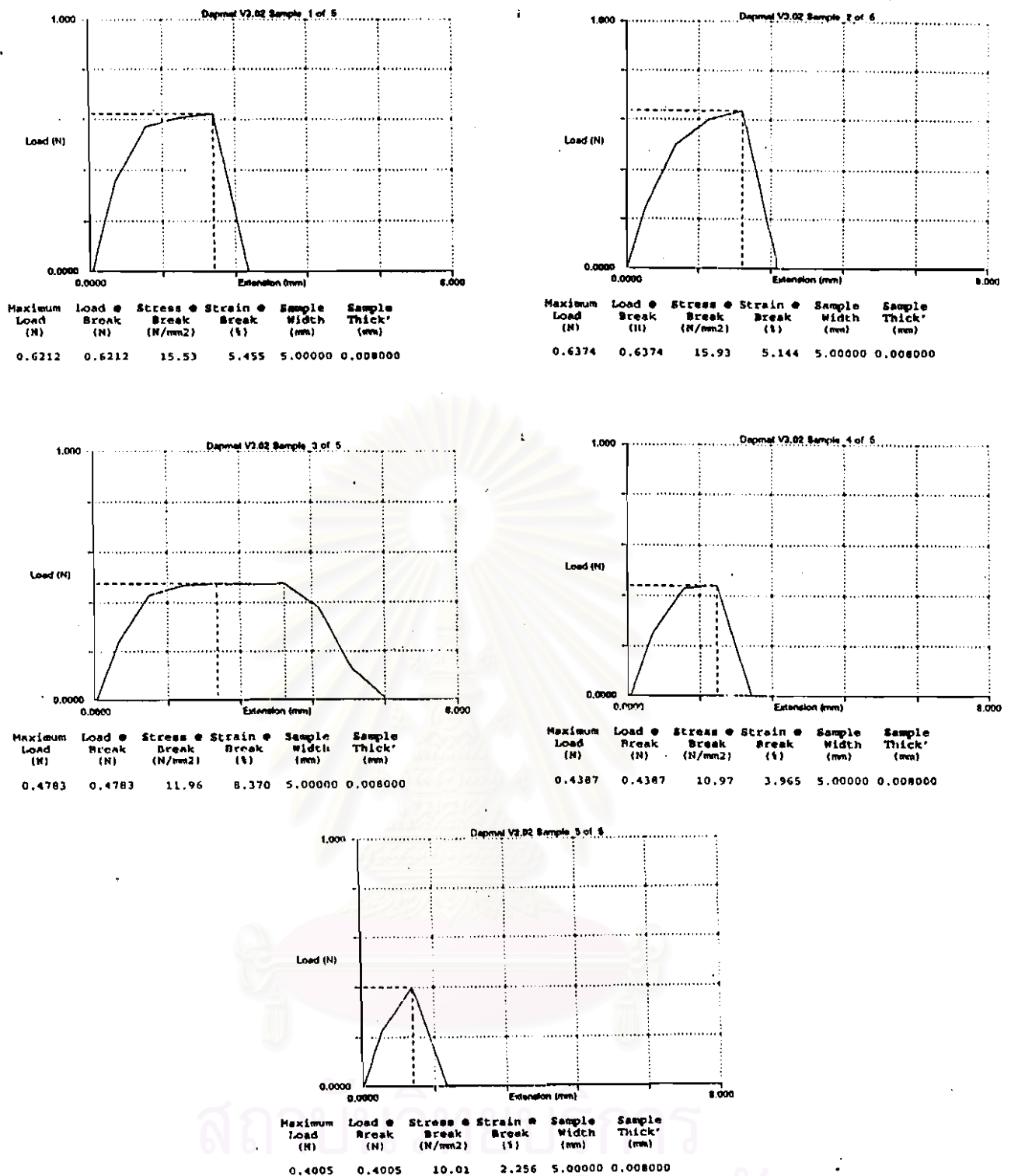
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.477	1.180	21.45	49.97	5.00000	0.011000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.289	1.205	24.10	42.25	5.00000	0.010000

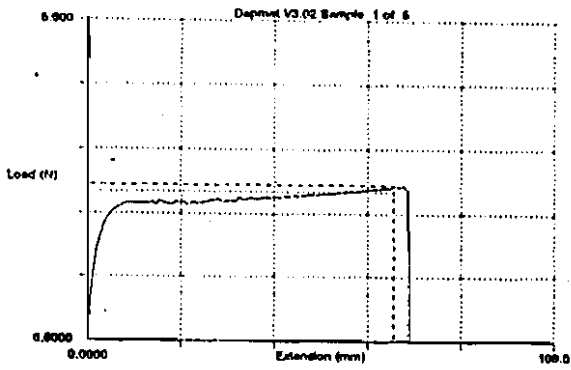
sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	1.094	1.064	19.34	16.88	5.000	0.0110
2	1.225	1.176	21.37	27.72	5.000	0.0110
3	1.202	1.011	18.39	26.73	5.000	0.0110
4	1.477	1.180	21.45	49.97	5.000	0.0110
5	1.289	1.205	24.10	42.25	5.000	0.0100
mean	1.258	1.127	20.93	32.71	5.000	0.0108
standard deviation	0.142	0.085	2.21	13.23	0.000	0.0004

Figure C12 Stress-strain curve of HDPE films after 20 weeks in outdoor exposure



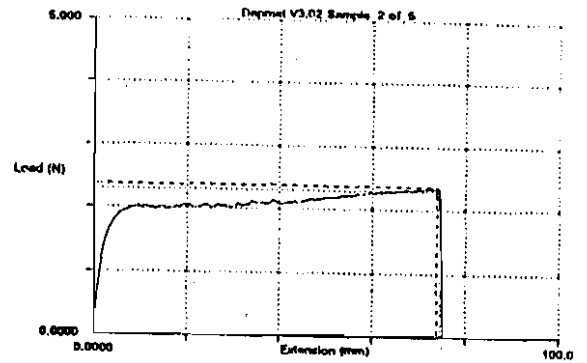
sample	Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	0.6212	0.6212	15.53	5.455	5.000	0.0080
2	0.6374	0.6374	15.93	5.144	5.000	0.0080
3	0.4783	0.4783	11.96	8.370	5.000	0.0080
4	0.4387	0.4387	10.97	3.965	5.000	0.0080
5	0.4005	0.4005	10.01	2.256	5.000	0.0080
mean	0.5152	0.5152	12.88	5.038	5.000	0.0080
standard deviation	0.1079	0.1079	2.70	2.246	0.000	0.0000

Figure C13 Stress-strain curve of exposure HDPE films after 23 weeks in outdoor exposure

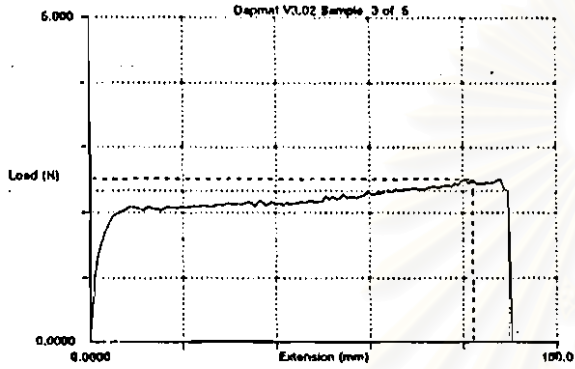


Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm2)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.446	2.339	31.19	137.1	5.00000	0.015000

XH2

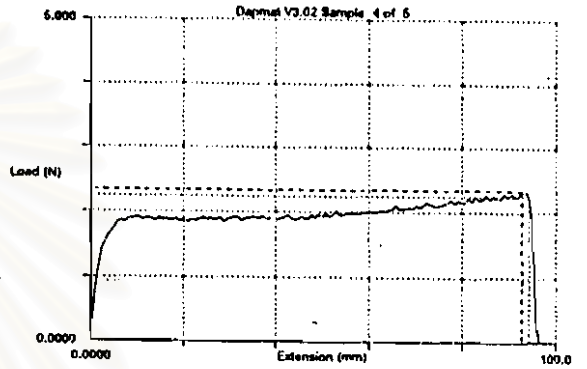


Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm2)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.379	2.299	30.65	149.2	5.00000	0.015000

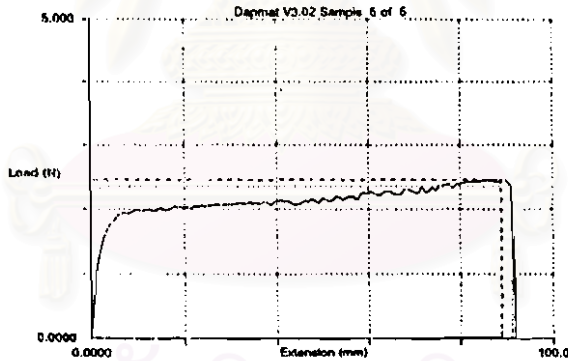


Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm2)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.523	2.336	31.15	179.1	5.00000	0.015000

XH2



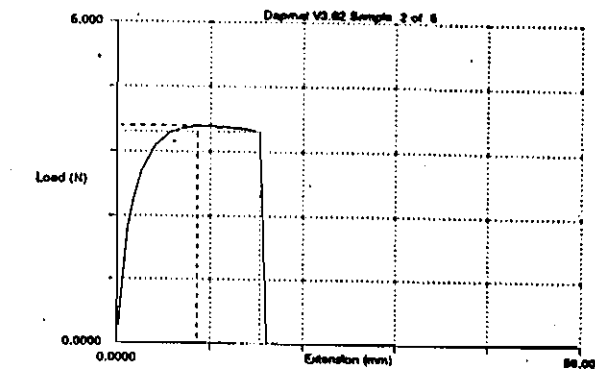
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm2)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.339	2.243	29.91	188.3	5.00000	0.015000



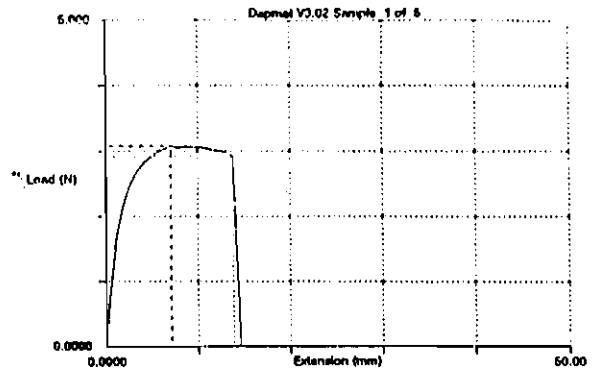
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm2)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.465	2.362	31.49	182.3	5.00000	0.015000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm2)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	2.446	2.339	31.19	137.1	5.000	0.0150
2	2.379	2.299	30.65	149.2	5.000	0.0150
3	2.523	2.336	31.15	179.1	5.000	0.0150
4	2.339	2.243	29.91	188.3	5.000	0.0150
5	2.465	2.362	31.49	182.3	5.000	0.0150
mean	2.430	2.316	30.88	167.2	5.000	0.0150
standard deviation	0.073	0.046	0.62	22.6	0.000	0.0000

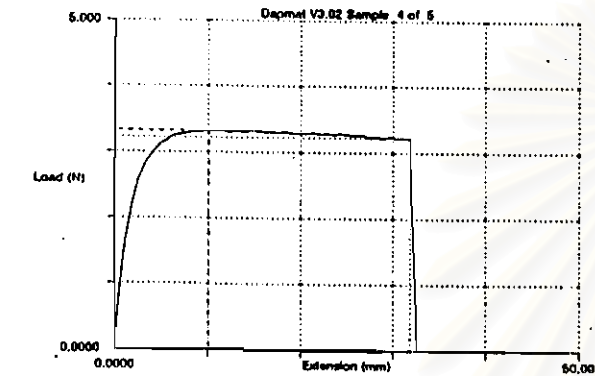
Figure C14 Stress-strain curve of HDPE films after 152 hours in Xenotest



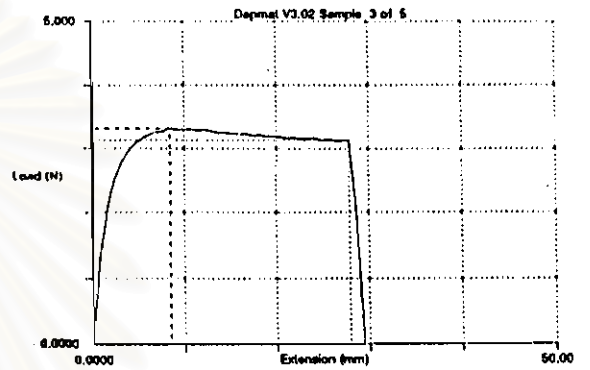
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.401	3.305	33.05	30.73	5.00000	0.020000



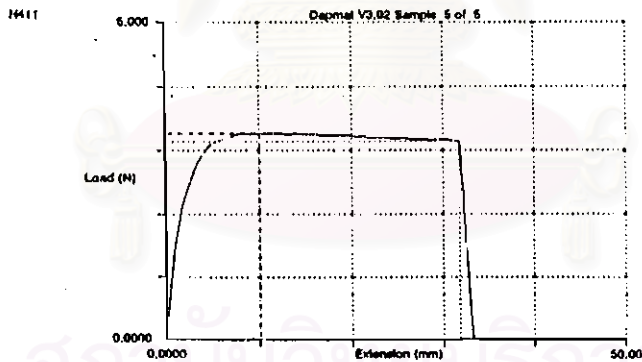
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.081	2.913	29.13	27.67	5.00000	0.020000



Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.332	3.222	32.22	63.65	5.00000	0.020000



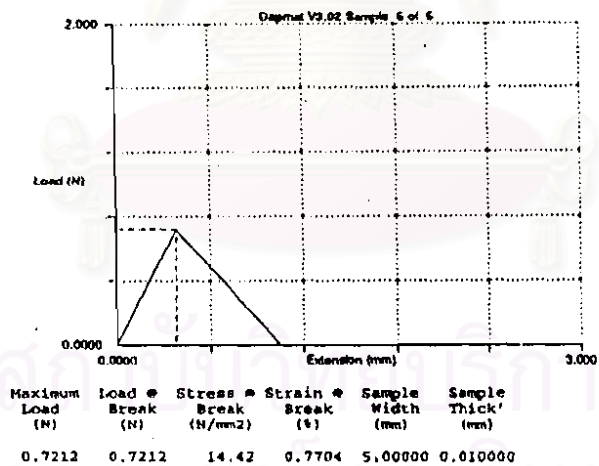
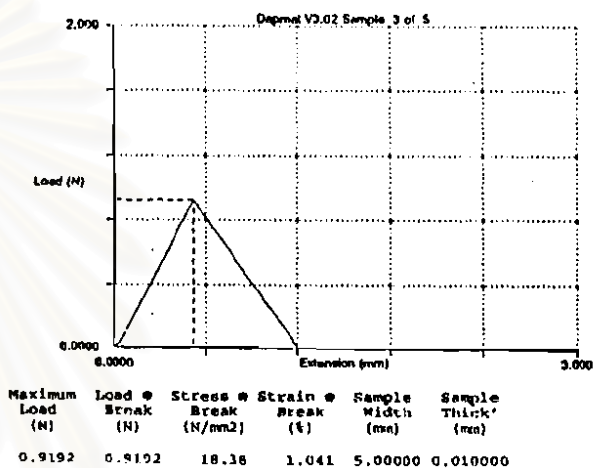
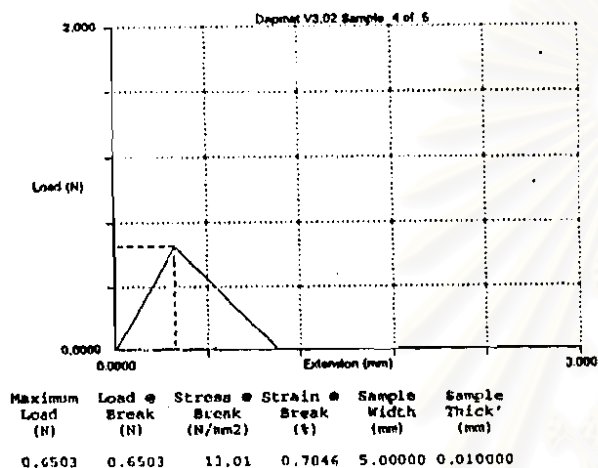
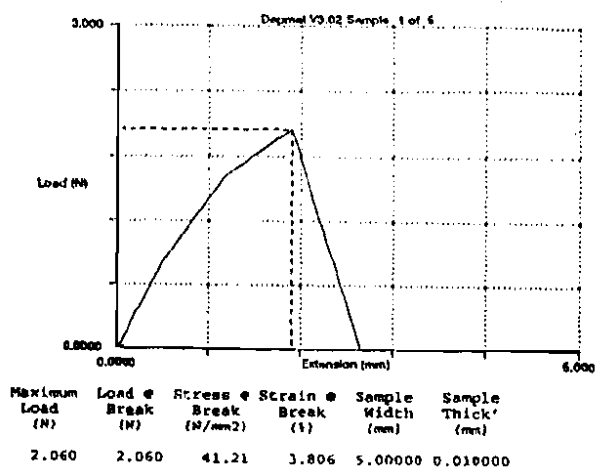
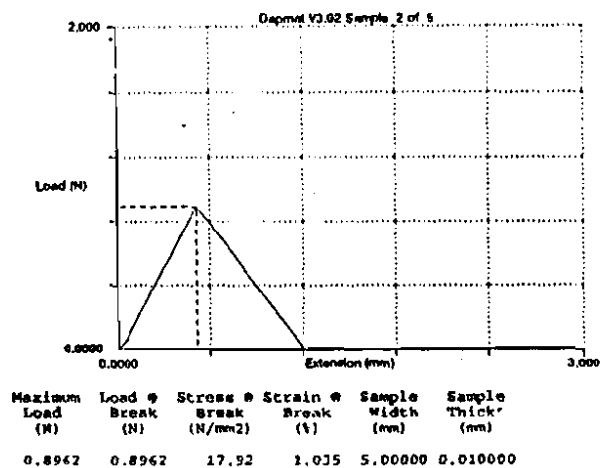
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.320	3.137	31.37	55.89	5.00000	0.020000



Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.267	3.141	31.41	63.56	5.00000	0.020000

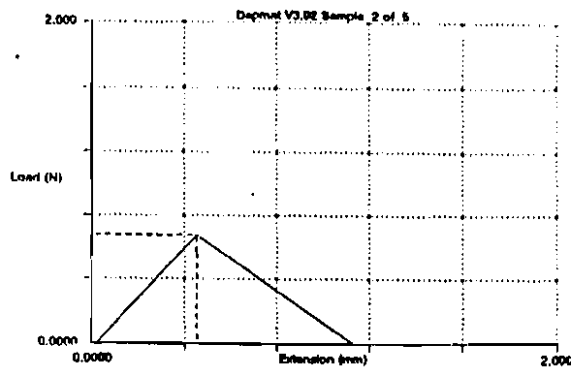
sample	Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.081	2.913	29.13	27.67	5.000	0.0200
2	3.401	3.305	33.05	30.73	5.000	0.0200
3	3.320	3.137	31.37	55.89	5.000	0.0200
4	3.332	3.222	32.22	63.65	5.000	0.0200
5	3.267	3.141	31.41	63.56	5.000	0.0200
mean	3.280	3.144	31.44	48.30	5.000	0.0200
standard deviation	0.121	0.146	1.46	17.75	0.000	0.0000

Figure C15 Stress-strain curve of HDPE films after 304 hours in Xenotest

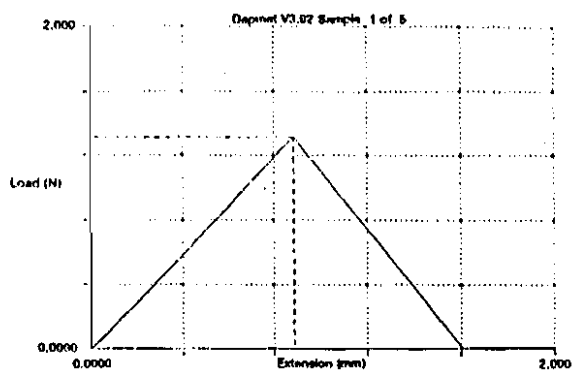


sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	2.060	2.060	41.21	3.806	5.000	0.0100
2	0.8962	0.8962	17.92	1.035	5.000	0.0100
3	0.9192	0.9192	18.38	1.041	5.000	0.0100
4	0.6503	0.6503	13.01	0.7846	5.000	0.0100
5	0.7212	0.7212	14.42	0.7704	5.000	0.0100
mean	1.049	1.049	20.99	1.487	5.000	0.0100
standard deviation	0.577	0.577	11.53	1.303	0.000	0.0000

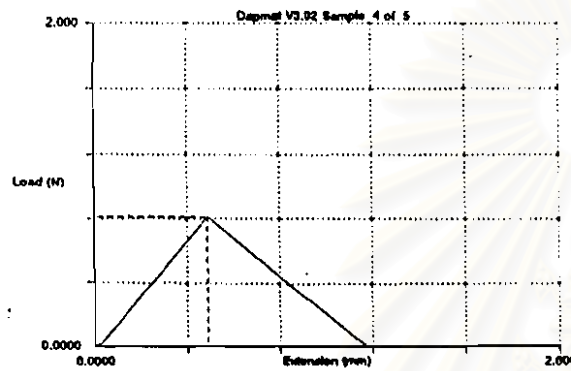
Figure C16 Stress-strain curve of HDPE films after 532 hours in Xenotest



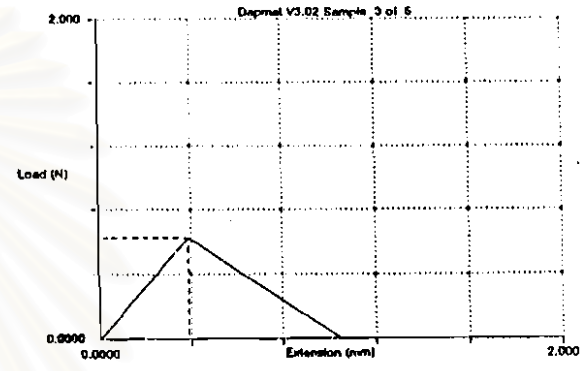
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
0.6722	0.6722	13.44	0.9043	5.00000	0.010000



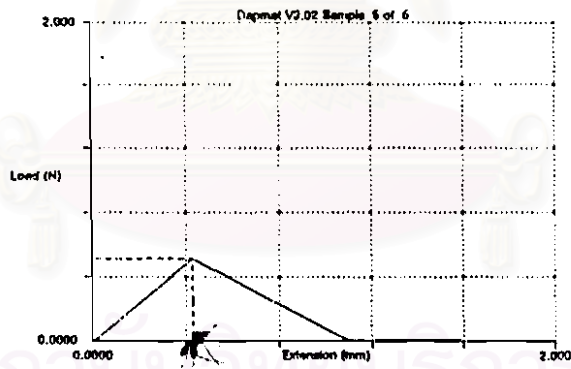
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.315	1.315	26.30	1.772	5.00000	0.010000



Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
0.8102	0.8102	16.20	0.9793	5.00000	0.010000



Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
0.6236	0.6236	12.47	0.7777	5.00000	0.010000



Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
0.5098	0.5098	10.20	0.8555	5.00000	0.010000

sample	Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	1.315	1.315	26.30	1.772	5.000	0.0100
2	0.6722	0.6722	13.44	0.9043	5.000	0.0100
3	0.6236	0.6236	12.47	0.7777	5.000	0.0100
4	0.8102	0.8102	16.20	0.9793	5.000	0.0100
5	0.5098	0.5098	10.20	0.8555	5.000	0.0100
mean	0.7862	0.7862	15.72	1.058	5.000	0.0100
standard deviation	0.3146	0.3146	6.29	0.406	0.000	0.0000

Figure C17 Stress-strain curve of HDPE films after 684 hours in Xenotest

Table C3 Changes in the mechanical properties of LDPE films
in response to various exposure times

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
0	1	612.00	139.71
	2	627.20	172.73
	3	640.70	157.66
	4	588.20	156.53
	5	639.30	154.38
	mean	621.5	156.20
	SD	21.89	11.73
	RSD	0.04	0.08
1	1	392.50	98.77
	2	429.20	137.97
	3	426.40	128.53
	4	392.30	117.72
	5	423.10	115.41
	mean	412.70	124.98
	SD	18.66	14.77
	RSD	0.05	0.12
2	1	445.60	122.01
	2	462.00	134.67
	3	492.50	126.05
	4	549.20	152.38
	5	427.90	116.46
	mean	475.40	130.31
	SD	47.60	14.01
	RSD	0.10	0.11
3	1	467.00	151.78
	2	558.70	149.79
	3	542.70	148.82
	4	595.20	135.04
	5	488.60	141.83
	mean	530.40	145.45
	SD	52.24	6.92
	RSD	0.10	0.05

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
4	1	495.90	158.73
	2	526.40	181.56
	3	507.50	171.07
	4	393.20	191.49
	5	481.60	142.03
	mean	480.9	168.98
	SD	51.71	19.37
	RSD	0.11	0.12
5	1	519.30	175.44
	2	512.10	156.99
	3	363.60	181.11
	4	526.70	142.33
	5	393.50	163.22
	mean	463.00	163.81
	SD	78.02	15.35
	RSD	0.17	0.09
6	1	471.30	143.28
	2	612.20	152.24
	3	556.50	178.11
	4	446.20	183.05
	5	544.90	189.93
	mean	526.21	169.32
	SD	67.23	20.37
	RSD	0.13	0.12
7	1	274.60	152.81
	2	304.40	177.36
	3	440.20	153.67
	4	198.30	150.32
	5	328.10	156.73
	mean	309.10	158.18
	SD	88.09	10.97
	RSD	0.28	0.07

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
8	1	420.30	127.87
	2	409.30	143.39
	3	550.90	184.98
	4	475.90	169.97
	5	374.10	194.64
	mean	446.1	174.79
	SD	69.06	28.04
	RSD	0.15	0.16
9	1	180.40	180.95
	2	171.30	202.34
	3	152.20	136.72
	4	139.70	224.86
	5	158.90	216.95
	mean	160.50	192.36
	SD	15.94	35.31
	RSD	0.10	0.18
10	1	155.60	171.75
	2	131.40	181.92
	3	134.70	172.88
	4	118.80	195.32
	5	170.50	180.79
	mean	142.20	180.53
	SD	20.62	9.44
	RSD	0.15	0.05
11	1	102.30	181.82
	2	123.00	184.07
	3	122.70	209.15
	4	105.50	207.67
	5	124.10	221.71
	mean	115.50	200.88
	SD	10.68	17.28
	RSD	0.09	0.09

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
12	1	110.50	180.12
	2	111.10	199.34
	3	114.70	167.52
	4	106.90	183.01
	5	104.10	163.20
	mean	109.5	178.64
	SD	4.08	14.25
	RSD	0.04	0.08
13	1	83.00	159.29
	2	53.77	171.25
	3	51.77	169.18
	4	91.60	178.29
	5	87.83	171.43
	mean	73.60	169.89
	SD	19.27	6.85
	RSD	0.26	0.03
14	1	48.13	167.52
	2	55.22	183.67
	3	66.95	208.33
	4	79.36	182.91
	5	58.12	185.61
	mean	61.56	185.61
	SD	12.02	14.62
	RSD	0.20	0.08
15	1	45.56	195.56
	2	52.38	186.99
	3	46.63	178.29
	4	47.21	178.38
	5	55.89	176.30
	mean	49.53	183.10
	SD	4.42	8.09
	RSD	0.09	0.04

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
16	1	70.02	212.22
	2	34.14	174.22
	3	55.50	213.78
	4	56.53	194.23
	5	54.04	171.46
	mean	54.04	193.18
	SD	12.84	20.12
	RSD	0.23	0.10
17	1	45.35	179.80
	2	36.36	180.18
	3	33.74	211.43
	4	53.27	199.22
	5	49.37	242.22
	mean	43.62	202.57
	SD	8.36	25.89
	RSD	0.19	0.13
18	1	74.72	184.21
	2	16.59	167.07
	3	42.31	173.84
	4	50.49	162.96
	5	57.95	191.55
	mean	48.41	175.93
	SD	21.43	11.87
	RSD	0.44	0.07
19	1	30.63	177.59
	2	35.62	201.18
	3	29.62	210.99
	4	39.44	253.97
	5	26.11	253.96
	mean	32.28	219.52
	SD	5.25	33.69
	RSD	0.16	0.15

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
20	1	29.99	184.62
	2	24.06	193.98
	3	26.29	200.00
	4	24.65	195.60
	5	32.79	200.24
	mean	27.55	194.89
	SD	3.73	6.35
	RSD	0.13	0.03
21	1	14.63	215.38
	2	17.89	163.03
	3	24.30	200.55
	4	28.86	240.63
	5	17.28	159.84
	mean	20.59	195.88
	SD	5.83	34.58
	RSD	0.28	0.18
22	1	21.03	174.71
	2	15.61	205.13
	3	23.79	256.41
	4	21.28	197.80
	5	23.04	189.35
	mean	20.95	204.68
	SD	3.20	31.05
	RSD	0.15	15.00
23	1	12.87	201.18
	2	14.22	153.85
	3	17.47	145.60
	4	21.78	182.69
	5	20.38	204.14
	mean	17.34	177.49
	SD	3.83	26.81
	RSD	0.22	0.15

Continued

Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Nature exposure	Nature exposure
24	1	8.28	178.93
	2	5.63	213.02
	3	5.20	218.80
	4	6.96	205.13
	5	3.63	191.52
	mean	5.94	201.48
	SD	1.77	16.23
	RSD	0.30	0.08

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Continued (Accelerated UV exposure)

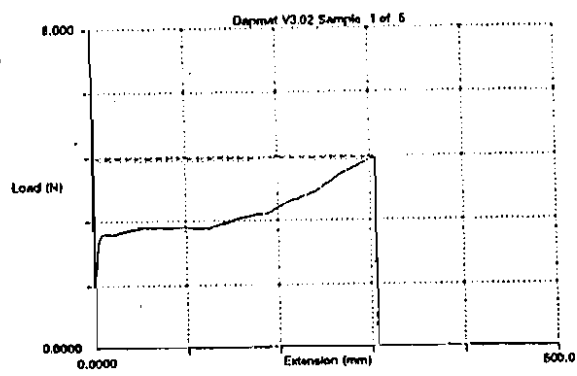
Xenotest exposure time (hours)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Accelerated UV exposure	Accelerated UV exposure
0	1	612.00	139.71
	2	627.20	172.66
	3	640.70	157.66
	4	588.20	156.53
	5	639.30	154.38
	mean	621.50	156.20
	SD	21.89	11.71
	RSD	0.04	0.07
76	1	518.90	196.62
	2	546.50	180.64
	3	557.00	152.22
	4	510.50	183.84
	5	555.40	170.70
	mean	537.70	176.80
	SD	21.54	16.57
	RSD	0.04	0.09
152	1	323.20	163.93
	2	469.60	157.14
	3	424.90	163.27
	4	357.20	162.86
	5	428.00	177.34
	mean	400.60	164.91
	SD	59.11	7.46
	RSD	0.15	0.04
228	1	362.20	158.73
	2	448.80	173.75
	3	486.60	189.19
	4	546.30	156.86
	5	489.30	169.63
	mean	466.70	169.63
	SD	67.98	13.05
	RSD	0.15	0.08

Continued

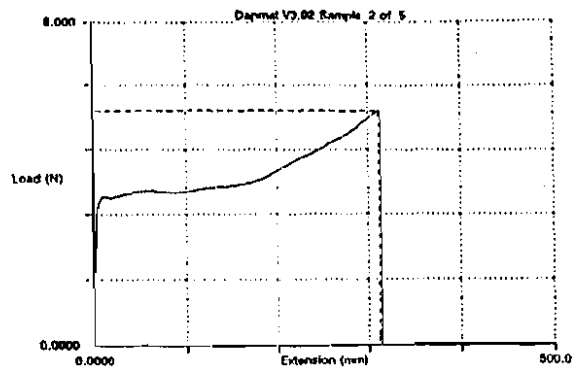
Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Accelerated UV exposure	Accelerated UV exposure
304	1	119.30	158.73
	2	133.70	173.75
	3	182.30	189.19
	4	125.30	199.25
	5	142.00	156.86
	mean	140.5	175.56
	SD	24.88	18.60
	RSD	0.18	0.11
380	1	286.70	186.29
	2	239.00	189.61
	3	331.90	199.49
	4	356.70	167.25
	5	188.10	191.33
	mean	280.50	186.79
	SD	68.46	11.96
	RSD	0.24	0.06
456	1	53.46	180.27
	2	54.96	188.21
	3	42.86	231.40
	4	33.79	199.02
	5	78.76	208.79
	mean	52.77	201.54
	SD	16.88	19.88
	RSD	0.32	0.10
532	1	49.03	265.78
	2	41.38	236.13
	3	42.77	267.40
	4	36.79	242.98
	5	47.29	239.32
	mean	43.45	250.32
	SD	4.87	15.06
	RSD	0.11	0.06

Continued

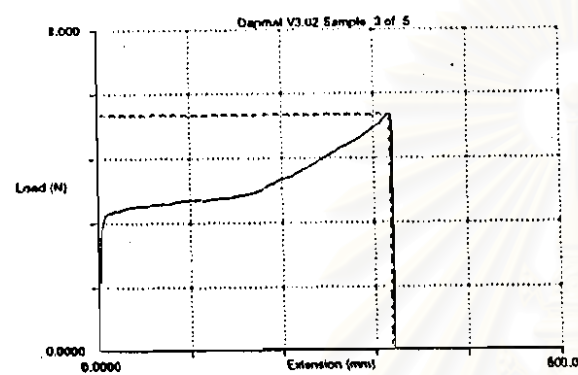
Nature exposure time (weeks)	Sample no.	Elongation at break (%)	Initial modulus (N/mm ²)
		Accelerated UV exposure	Accelerated UV exposure
608	1	60.94	267.43
	2	51.78	264.96
	3	57.85	249.11
	4	50.28	242.98
	5	42.70	242.73
	mean	52.71	253.44
	SD	7.09	11.95
	RSD	0.13	0.05
684	1	37.06	250.55
	2	52.87	284.24
	3	46.96	275.91
	4	30.64	253.47
	5	29.20	225.03
	mean	39.34	257.84
	SD	10.31	23.30
	RSD	0.26	0.09
760	1	27.44	268.82
	2	27.27	252.66
	3	29.28	257.43
	4	32.20	267.86
	5	36.45	251.43
	mean	30.55	259.64
	SD	3.86	8.26
	RSD	0.13	0.03
836	1	24.62	227.56
	2	17.17	243.39
	3	15.55	247.71
	4	17.96	207.33
	5	17.04	255.78
	mean	18.47	243.61
	SD	3.55	19.21
	RSD	0.19	0.08



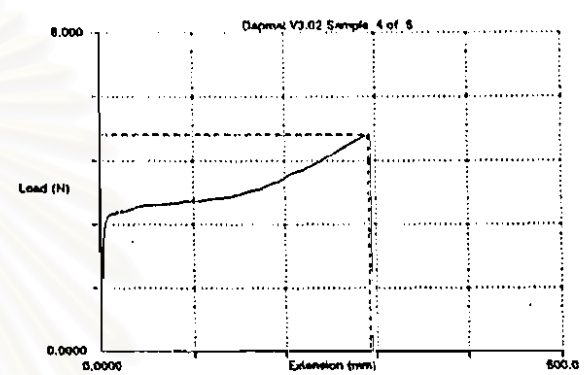
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
4.769	4.711	15.45	612.0	5.00000	0.061000



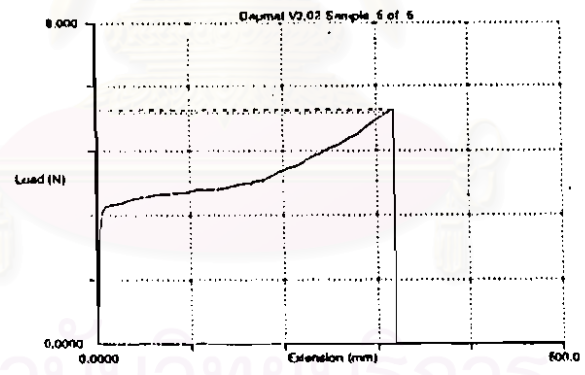
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
5.775	5.760	18.89	627.2	5.00000	0.061000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
5.880	5.842	16.93	640.7	5.00000	0.069000



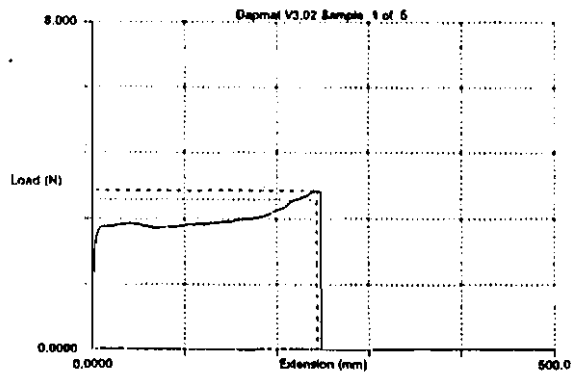
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
5.489	5.458	15.59	588.2	5.00000	0.070000



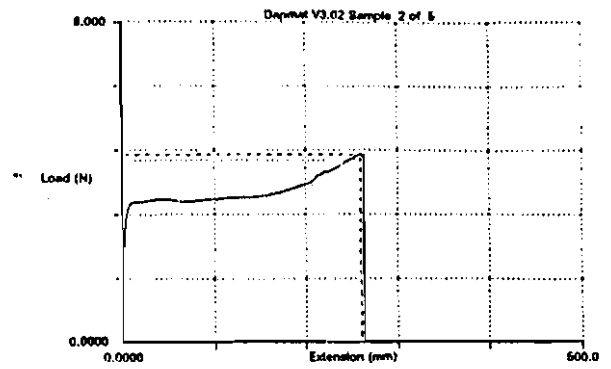
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
5.819	5.735	16.39	639.3	5.00000	0.070000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	4.769	4.711	15.45	612.0	5.000	0.0610
2	5.775	5.760	18.89	627.2	5.000	0.0610
3	5.880	5.842	16.93	640.7	5.000	0.0690
4	5.489	5.458	15.59	588.2	5.000	0.0700
5	5.819	5.735	16.39	639.3	5.000	0.0700
mean	5.546	5.501	16.65	621.5	5.000	0.0662
standard deviation	0.460	0.465	1.39	21.9	0.000	0.0048

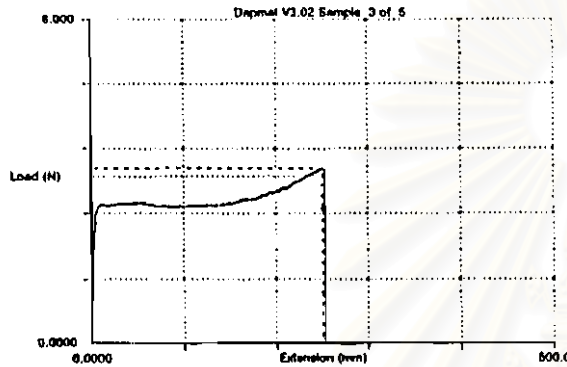
Figure C18 Stress-strain curve of unexposed LDPE films



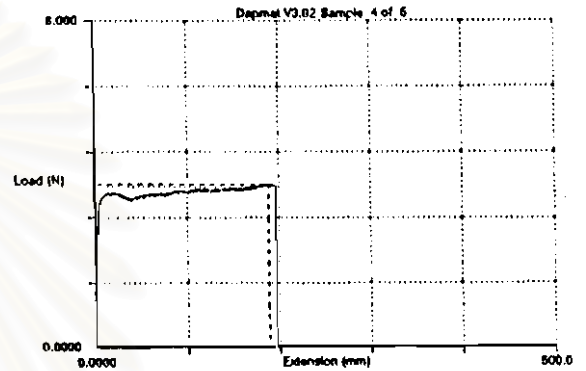
Maximum Load (N)	Load @ Break (N)	Stress Break (N/mm2)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.882	3.668	10.79	495.9	5.00000	0.068000



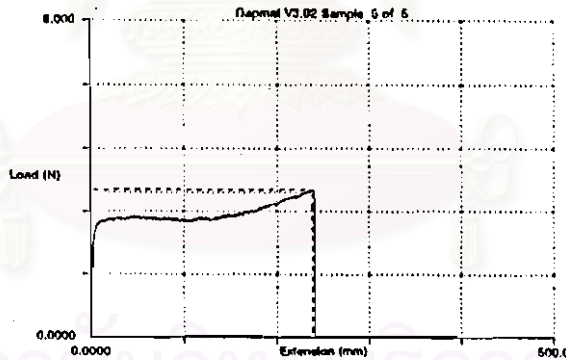
Maximum Load (N)	Load @ Break (N)	Stress Break (N/mm2)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
4.696	4.547	13.18	526.4	5.00000	0.069000



Maximum Load (N)	Load @ Break (N)	Stress Break (N/mm2)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
4.322	4.120	11.94	507.5	5.00000	0.069000



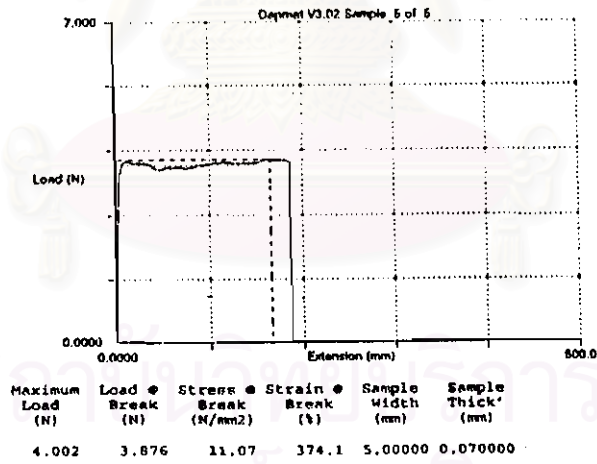
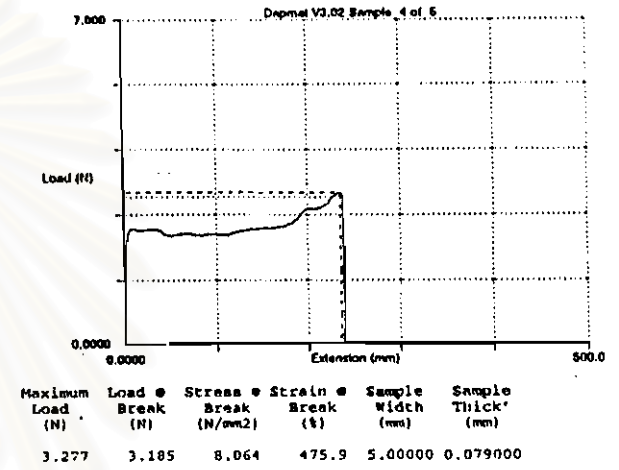
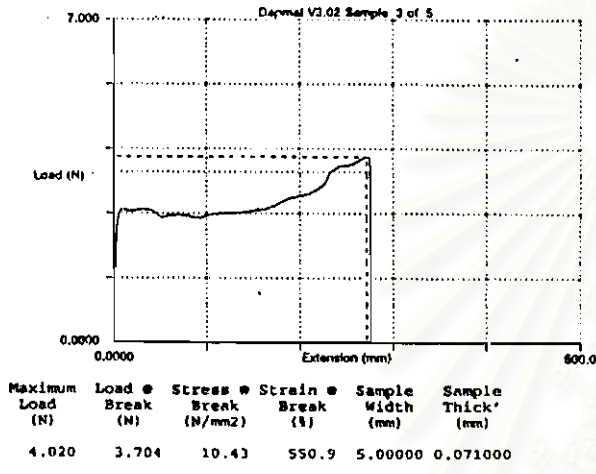
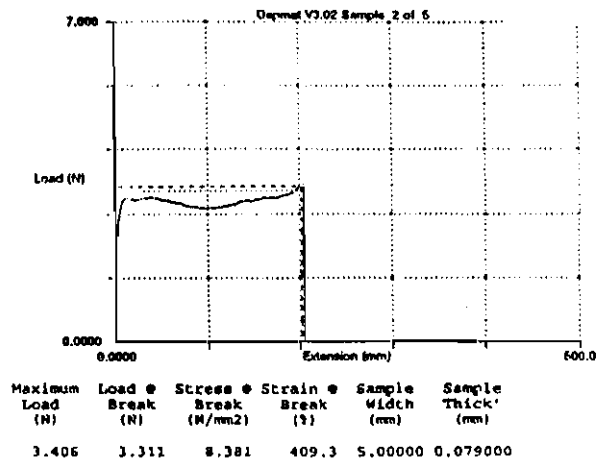
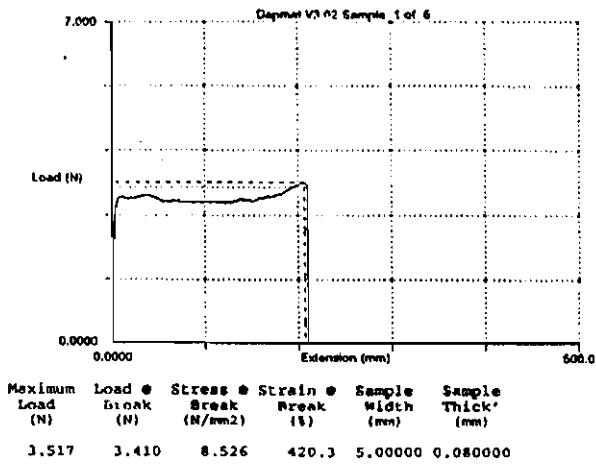
Maximum Load (N)	Load @ Break (N)	Stress Break (N/mm2)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
4.011	3.939	11.25	393.2	5.00000	0.070000



Maximum Load (N)	Load @ Break (N)	Stress Break (N/mm2)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.753	3.680	10.52	481.6	5.00000	0.070000

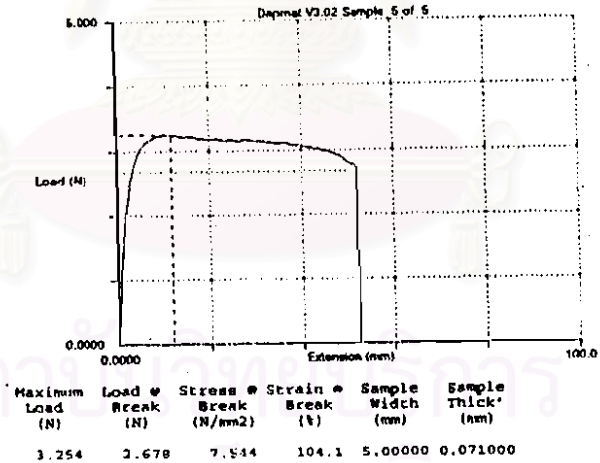
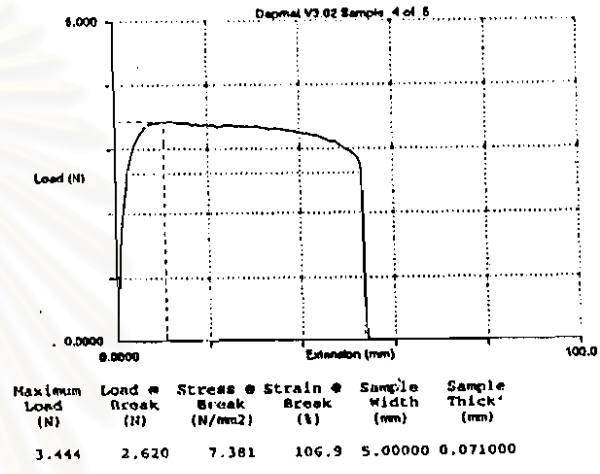
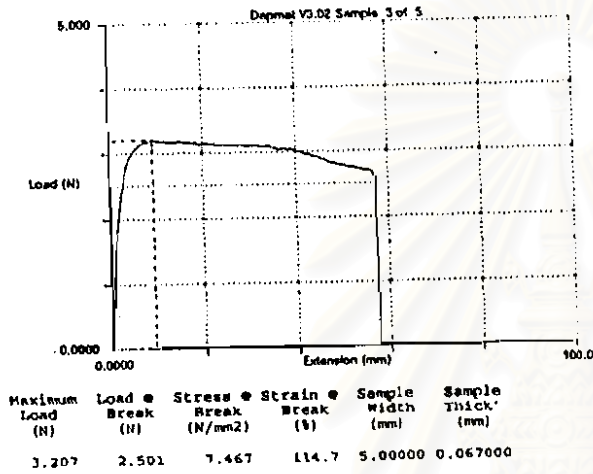
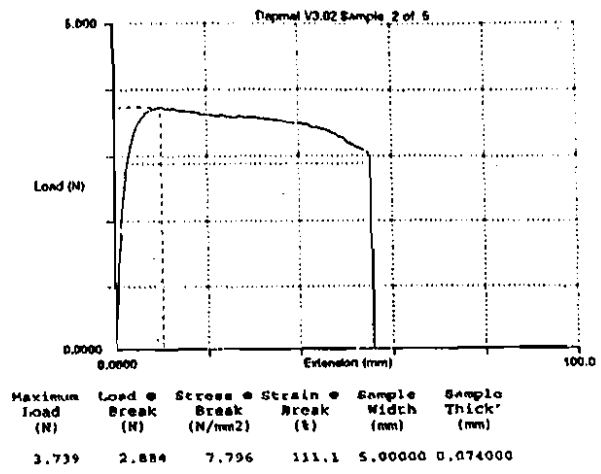
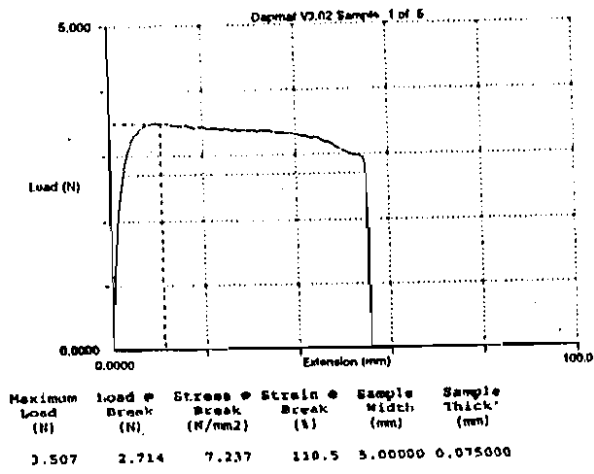
sample	Maximum Load (N)	Load @ Break (N)	Stress Break (N/mm2)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.882	3.668	10.79	495.9	5.000	0.0680
2	4.696	4.547	13.18	526.4	5.000	0.0690
3	4.322	4.120	11.94	507.5	5.000	0.0690
4	4.011	3.939	11.25	393.2	5.000	0.0700
5	3.753	3.680	10.52	481.6	5.000	0.0700
mean	4.133	3.991	11.54	480.9	5.000	0.0692
standard deviation	0.379	0.364	1.07	51.7	0.000	0.0008

Figure C19 Stress-strain curve of LDPE films after 4 weeks in outdoor exposure



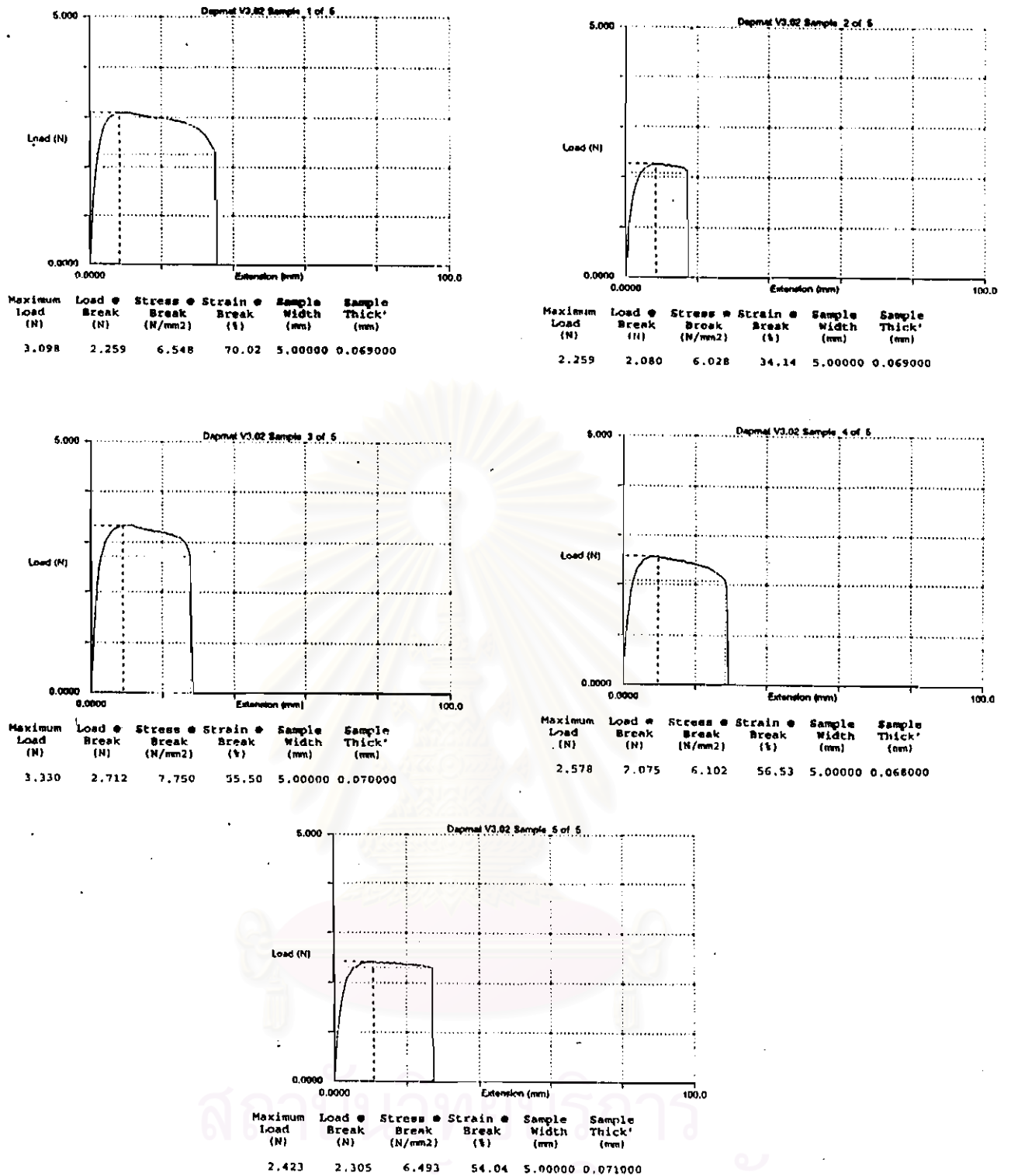
sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm2)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.517	3.410	8.526	420.3	5.000	0.0800
2	3.406	3.311	8.381	409.3	5.000	0.0790
3	4.020	3.704	10.43	550.9	5.000	0.0710
4	3.277	3.185	8.064	475.9	5.000	0.0790
5	4.002	3.876	11.07	374.1	5.000	0.0700
mean	3.644	3.497	9.296	446.1	5.000	0.0758
standard deviation	0.345	0.285	1.360	69.1	0.000	0.0049

Figure C20 Stress-strain curve of LDPE films after 8 weeks in outdoor exposure



sample	Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	2.044	1.792	32.59	110.2	5.000	0.0110
2	2.104	1.920	34.92	101.3	5.000	0.0110
3	2.325	2.069	34.49	79.91	5.000	0.0120
4	2.241	1.905	27.22	96.34	5.000	0.0140
5	2.246	1.868	31.14	104.2	5.000	0.0120
mean	2.192	1.911	32.07	98.37	5.000	0.0120
standard deviation	0.115	0.101	3.11	11.47	0.000	0.0012

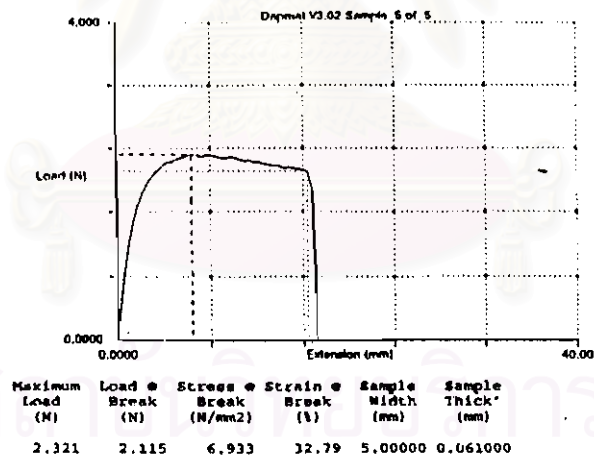
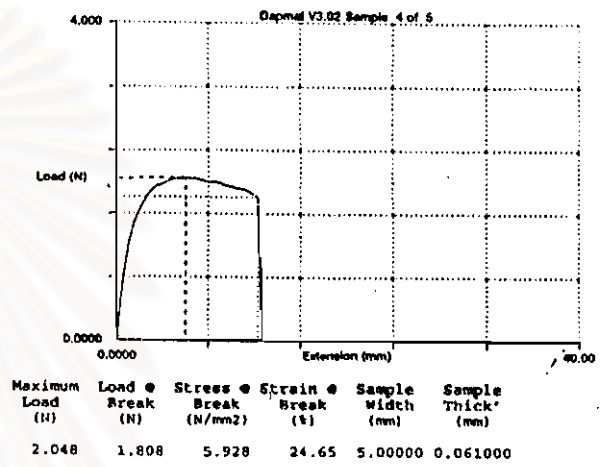
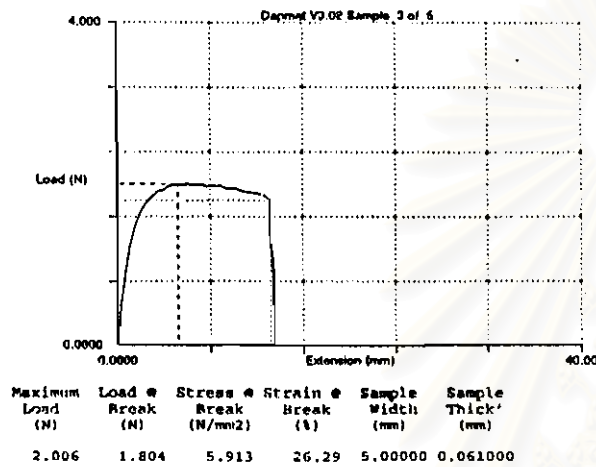
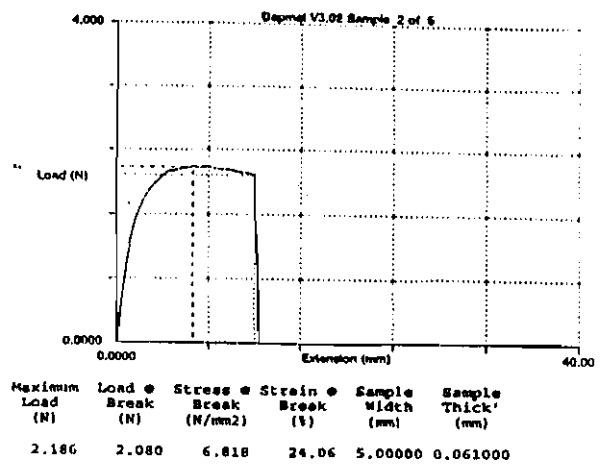
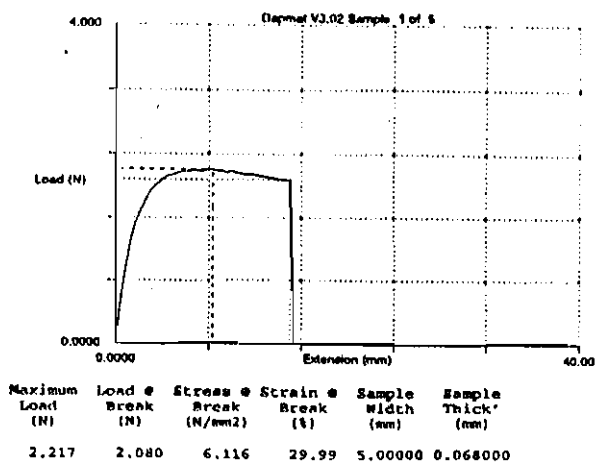
Figure C21 Stress-strain curve of LDPE films after 12 weeks in outdoor exposure



จุฬาลงกรณ์มหาวิทยาลัย

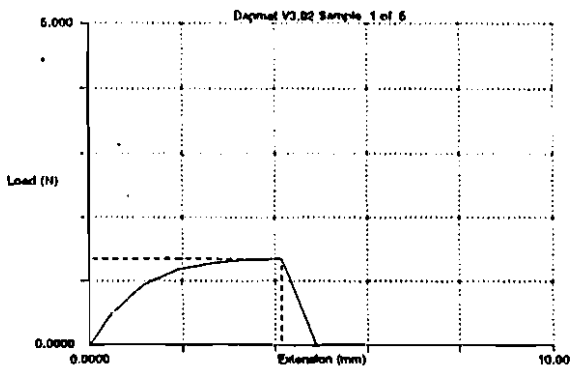
sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.098	2.259	6.548	70.02	5.000	0.0690
2	2.259	2.080	6.028	34.14	5.000	0.0690
3	3.330	2.712	7.750	55.50	5.000	0.0700
4	2.578	2.075	6.102	56.53	5.000	0.0680
5	2.423	2.305	6.493	54.04	5.000	0.0710
mean	2.738	2.286	6.584	54.04	5.000	0.0694
standard deviation	0.457	0.260	0.691	12.84	0.000	0.0011

Figure C22 Stress-strain curve of LDPE films after 16 weeks in outdoor exposure

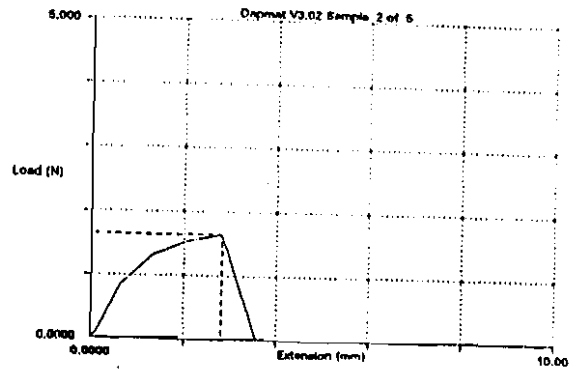


sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	2.217	2.080	6.116	29.99	5.000	0.0680
2	2.186	2.080	6.818	24.06	5.000	0.0610
3	2.006	1.804	5.913	26.29	5.000	0.0610
4	2.048	1.808	5.928	24.65	5.000	0.0610
5	2.321	2.115	6.933	32.79	5.000	0.0610
mean	2.156	1.977	6.342	27.55	5.000	0.0624
standard deviation	0.128	0.157	0.496	3.73	0.000	0.0031

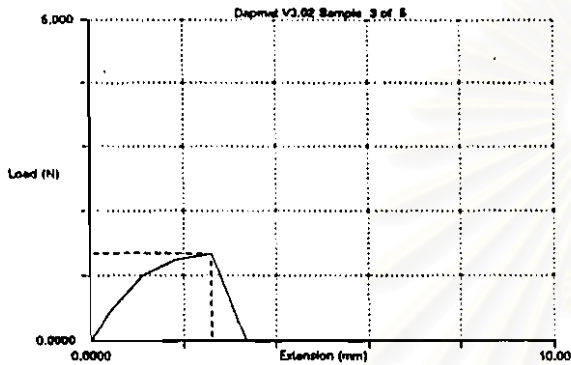
Figure C23 Stress-strain curve of LDPE films after 20 weeks in outdoor exposure



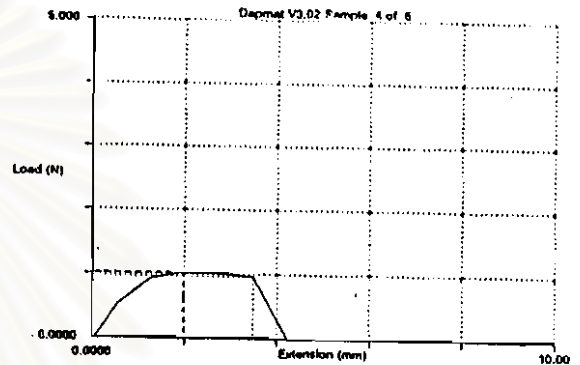
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.340	1.340	4.962	8.278	5.00000	0.054000



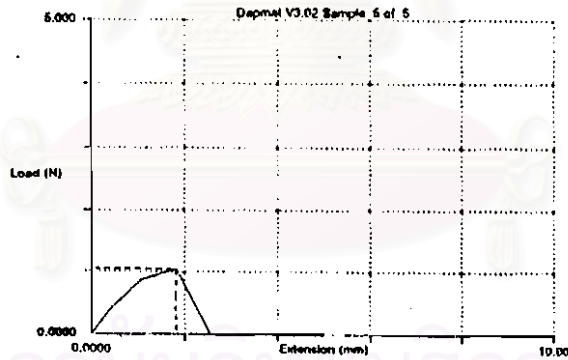
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.640	1.640	4.754	5.629	5.00000	0.069000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.331	1.331	3.974	5.201	5.00000	0.067000



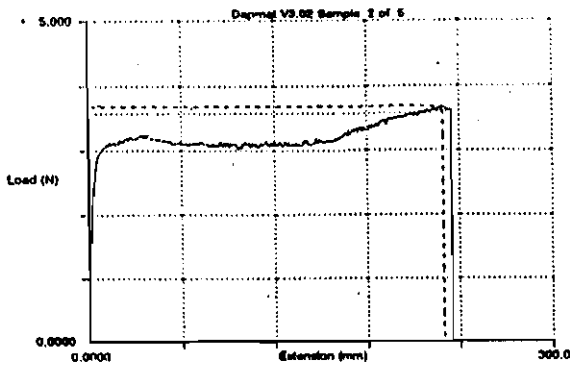
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.013	0.9596	2.822	6.959	5.00000	0.068000



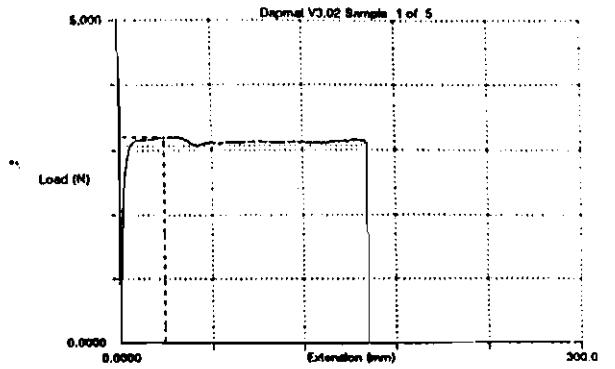
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1.047	1.047	3.222	3.634	5.00000	0.065000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	1.340	1.340	4.962	8.278	5.000	0.0540
2	1.640	1.640	4.754	5.629	5.000	0.0690
3	1.331	1.331	3.974	5.201	5.000	0.0670
4	1.013	0.9596	2.822	6.959	5.000	0.0680
5	1.047	1.047	3.222	3.634	5.000	0.0650
mean	1.274	1.264	3.947	5.940	5.000	0.0646
standard deviation	0.256	0.270	0.932	1.765	0.000	0.0061

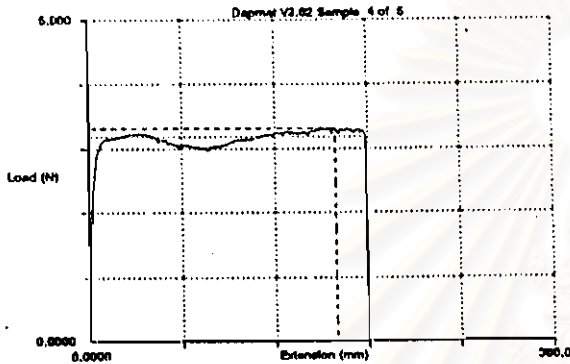
Figure C24 Stress-strain curve of LDPE films after 24 weeks in outdoor exposure



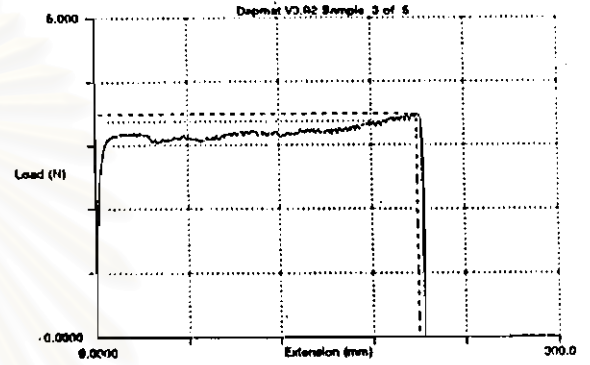
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.693	3.586	11.57	469.6	5.00000	0.062000



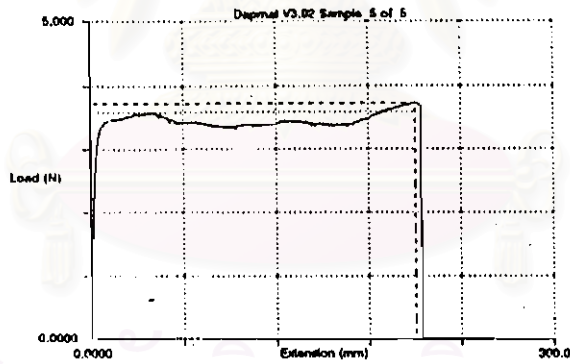
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.210	3.069	9.898	323.2	5.00000	0.062000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.310	3.188	9.809	357.2	5.00000	0.065000



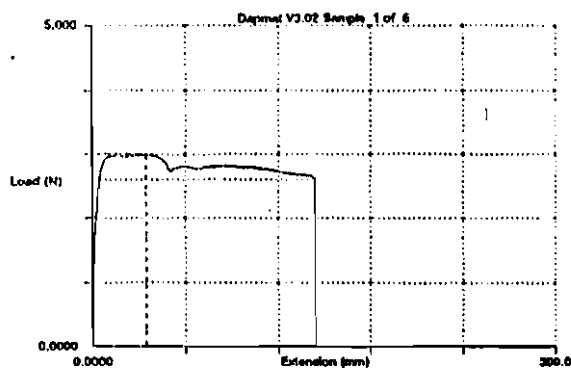
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.499	3.381	10.40	474.9	5.00000	0.065000



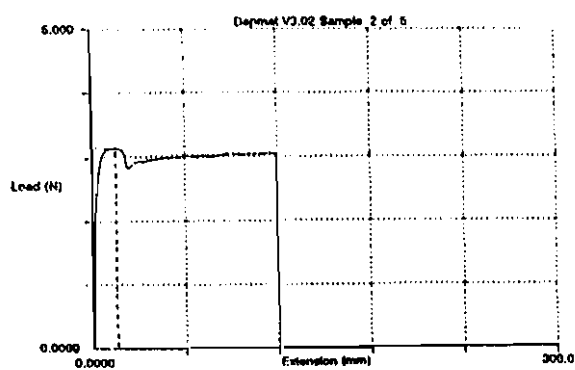
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.733	3.592	11.05	428.0	5.00000	0.065000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.210	3.069	9.898	323.2	5.000	0.0620
2	3.693	3.586	11.57	469.6	5.000	0.0620
3	3.499	3.381	10.40	424.9	5.000	0.0650
4	3.310	3.188	9.809	357.2	5.000	0.0650
5	3.733	3.592	11.05	428.0	5.000	0.0650
mean	3.489	3.363	10.55	400.6	5.000	0.0638
standard deviation	0.230	0.235	0.76	59.1	0.000	0.0016

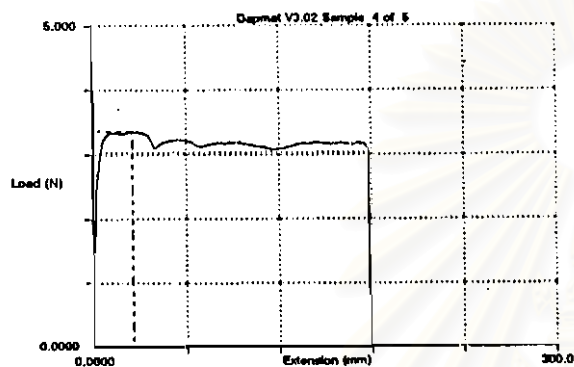
Figure C25 Stress-strain curve of LDPE films after 152 hours in Xenotest



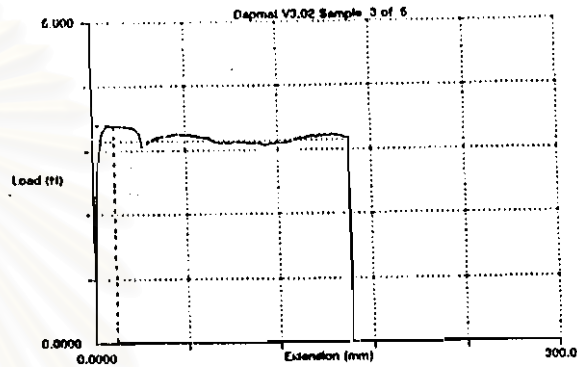
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.014	2.606	7.445	286.7	5.00000	0.070000



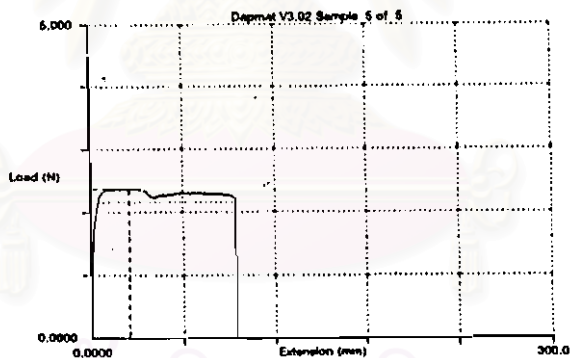
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.162	3.029	8.654	239.0	5.00000	0.070000



Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.369	3.037	8.676	356.7	5.00000	0.070000



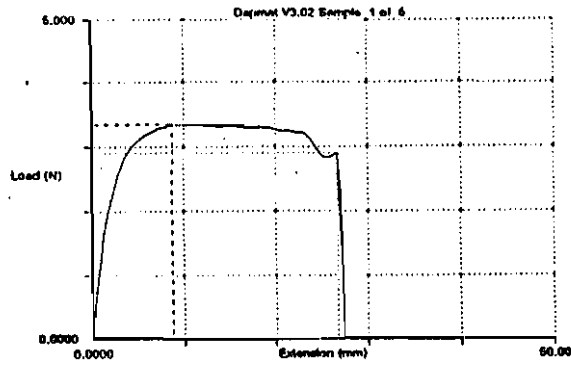
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.404	3.145	8.985	331.9	5.00000	0.070000



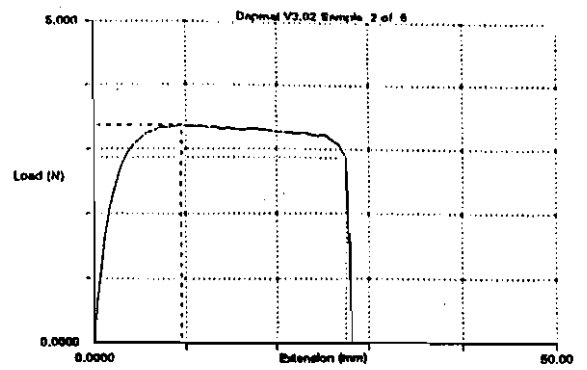
Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
2.370	2.156	6.160	188.1	5.00000	0.070000

sample	Maximum Load (N)	Load Break (N)	Stress Break (N/mm ²)	Strain Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.014	2.606	7.445	286.7	5.000	0.0700
2	3.162	3.029	8.654	239.0	5.000	0.0700
3	3.404	3.145	8.985	331.9	5.000	0.0700
4	3.369	3.037	8.676	356.7	5.000	0.0700
5	2.370	2.156	6.160	188.1	5.000	0.0700
mean	3.064	2.794	7.984	280.5	5.000	0.0700
standard deviation	0.419	0.412	1.177	68.5	0.000	0.0000

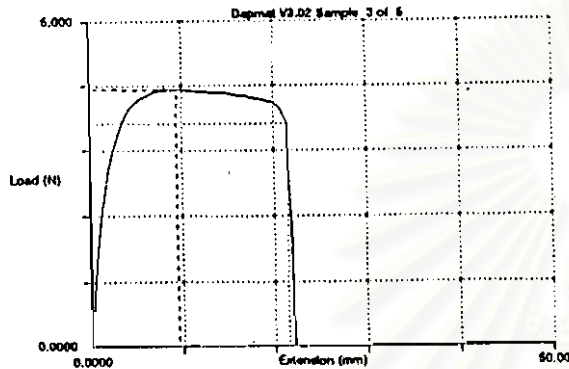
Figure C26 Stress-strain curve of LDPE films after 304 hours in Xenotest



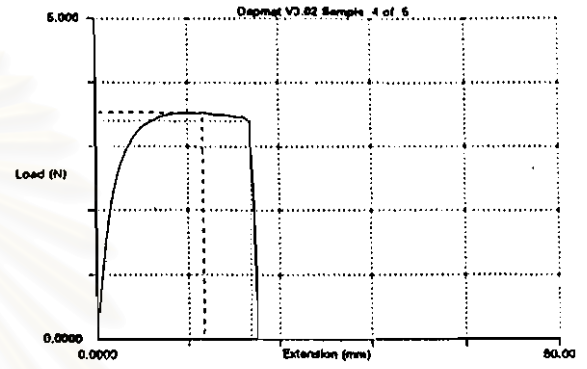
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.355	2.901	9.358	53.46	5.00000	0.062000



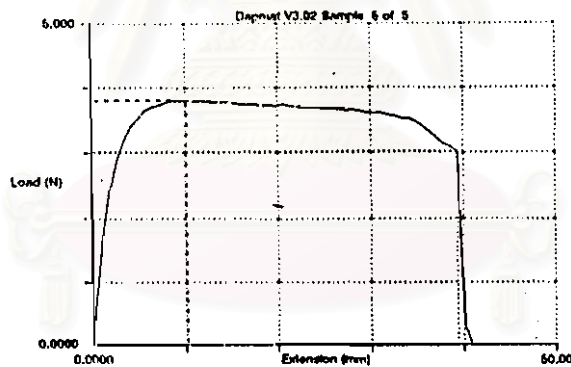
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.370	2.870	9.258	54.96	5.00000	0.062000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.945	3.415	11.02	42.86	5.00000	0.062000



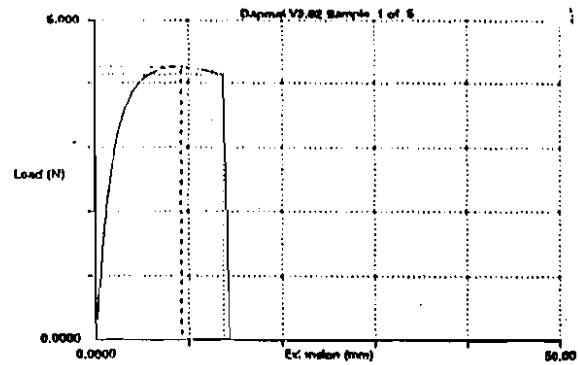
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.539	3.402	10.97	33.79	5.00000	0.062000



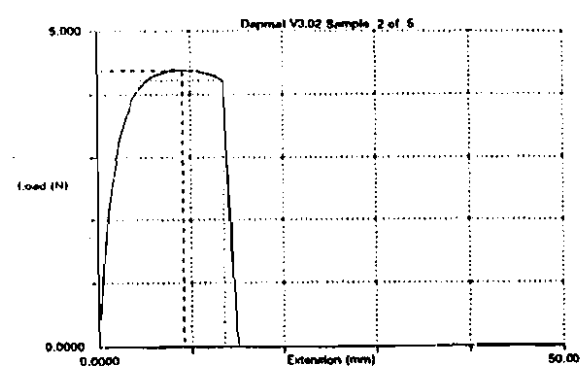
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
3.804	3.018	9.736	78.76	5.00000	0.062000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	3.355	2.901	9.358	53.46	5.000	0.0620
2	3.370	2.870	9.258	54.96	5.000	0.0620
3	3.945	3.415	11.02	42.86	5.000	0.0620
4	3.539	3.402	10.97	33.79	5.000	0.0620
5	3.804	3.018	9.736	78.76	5.000	0.0620
mean	3.603	3.121	10.07	52.77	5.000	0.0620
standard deviation	0.263	0.268	0.86	16.88	0.000	0.0000

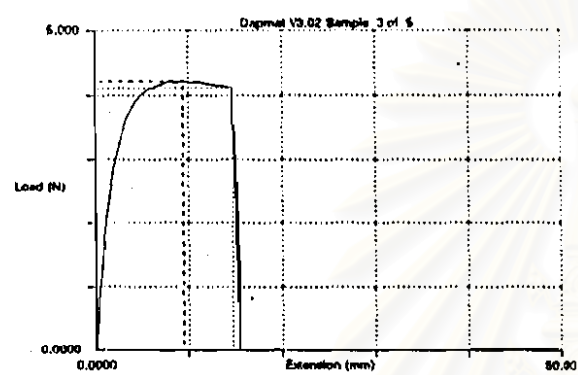
Figure C27 Stress-strain curve of LDPE films after 456 hours in Xenotest



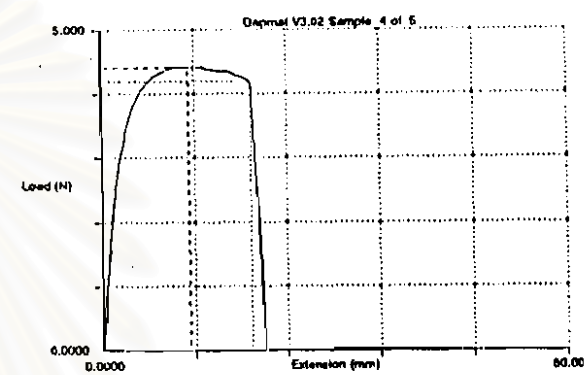
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
4.262	4.128	11.01	27.44	5.0000	0.075000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
4.394	4.230	11.28	27.27	5.0000	0.075000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
4.236	4.129	11.01	29.38	5.0000	0.075000



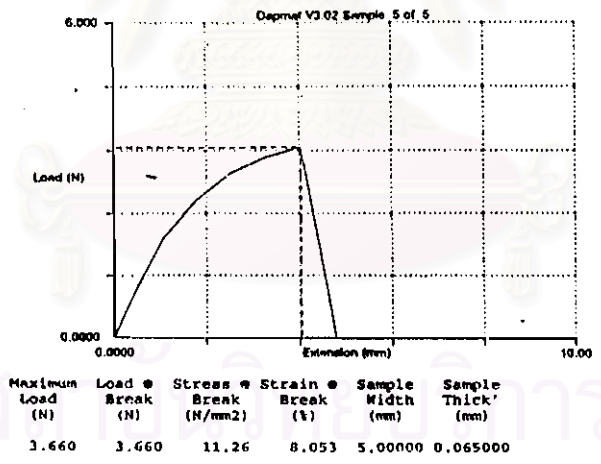
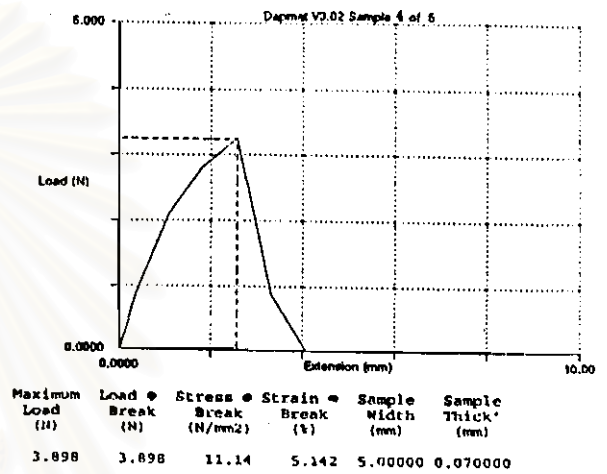
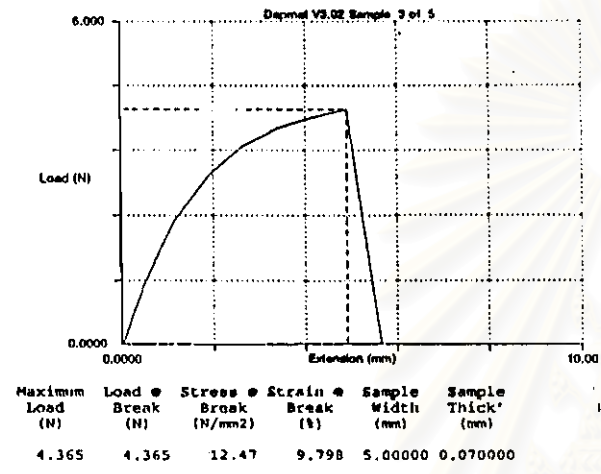
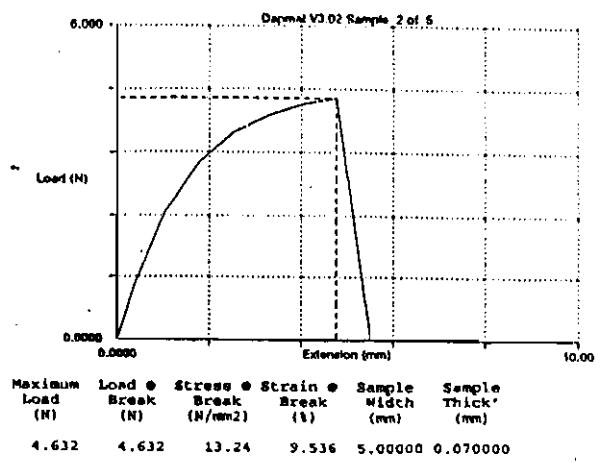
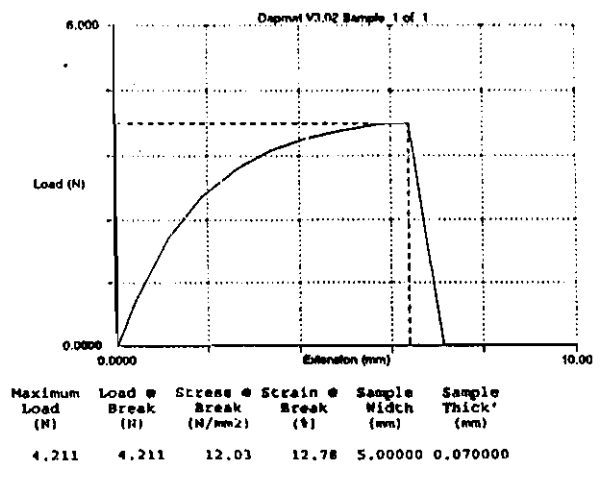
Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
4.419	4.205	11.21	32.20	5.0000	0.075000



Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
4.368	4.120	10.99	36.45	5.0000	0.075000

sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	4.262	4.128	11.01	27.44	5.000	0.0750
2	4.394	4.230	11.28	27.27	5.000	0.0750
3	4.236	4.129	11.01	29.38	5.000	0.0750
4	4.419	4.205	11.21	32.20	5.000	0.0750
5	4.368	4.120	10.99	36.45	5.000	0.0750
mean	4.336	4.162	11.10	30.55	5.000	0.0750
standard deviation	0.082	0.051	0.14	3.85	0.000	0.0000

Figure C28 Stress-strain curve of LDPE films after 760 hours in Xenotest



Sample	Maximum Load (N)	Load @ Break (N)	Stress @ Break (N/mm ²)	Strain @ Break (%)	Sample Width (mm)	Sample Thick' (mm)
1	4.211	4.211	12.03	12.78	5.000	0.0700
2	4.632	4.632	13.24	9.54	5.000	0.0700
3	4.365	4.365	12.47	9.70	5.000	0.0700
4	3.898	3.898	11.14	5.142	5.000	0.0700
5	3.660	3.660	11.26	8.053	5.000	0.0650
mean	4.153	4.153	12.028	9.043	5.000	0.069
standard deviation	0.383	0.383	0.872	2.777	0.000	0.002

Figure C29 Stress-strain curve of LDPE films after 912 hours in Xenotest

CURRICULUM VITAE

Miss Pompen Atorngitjawat was born in Chonburi, Thailand, on April 2, 1972. She received a Bachelor of Science degree with a major in Polymer Science and Textile from Chulalongkorn University in 1994. She started as graduate student in Department of Materials Science with a major in Applied Polymer Science and Textile Technology, Chulalongkorn University in June 1994, and completed the programme in October 1996.



สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย