Electronic Supplementary Material (ESI) for Green Chemistry.

Electronic Supporting Information

Efficient and Stable Star-Shaped Plasticizer for Starch: Cyclic Phosphazene with Hydrogen Bonding Aminoethoxy Ethanol Side Chains

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Mass spectroscopy

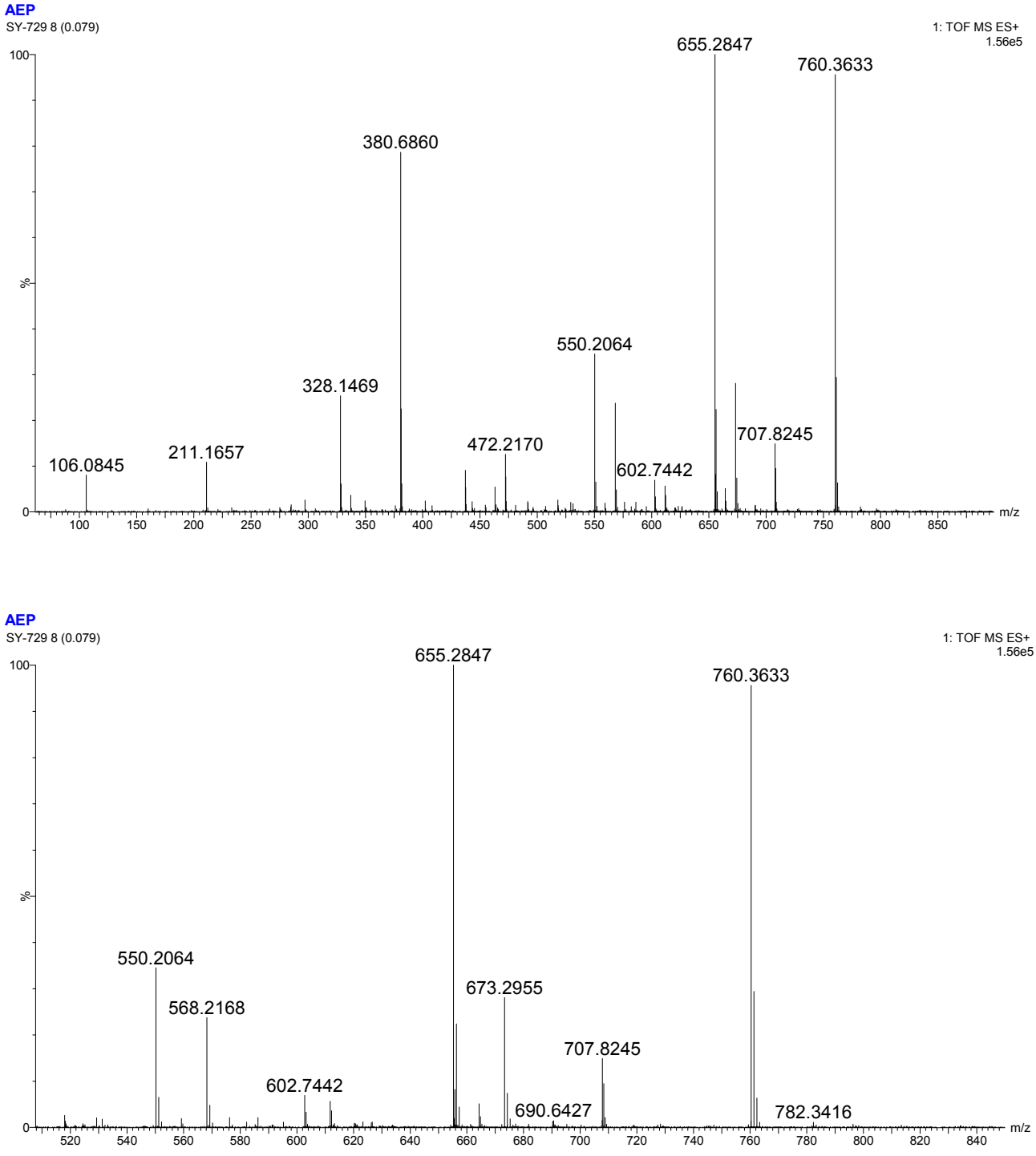

Figure SI 1 - MS spectra of pure AEEP

Element prediction: Off

Number of isotope peaks used for i-FIT = 3

Monoisotopic Mass, Even Electron Ions

855 formula(e) evaluated with 4 results within limits (up to 50 closest results for each mass)

Elements Used:

C: 0-100 H: 0-100 N: 6-15 O: 6-20 P: 3-3

Minimum: -1.5

Maximum: 5.0 3.0 50.0

Table S1 – MS spectroscopy data

Mass	Calc. Mass	mDa	PPM	DBE	i-FIT	Norm	Conf(%)	Formula
760.3633	760.3626	0.7	0.9	1.5	289.1	4.994	0.68	C20 H57 N15 O10 P3
	760.3653	-2.0	-2.6	0.5	284.1	0.028	97.29	C24 H61 N9 O12 P3
	760.3666	-3.3	-4.3	5.5	288.0	3.899	2.3	C25 H57 N13 O8 P3
	760.3594	3.9	5.1	9.5	293.4	9.329	0.01	C31 H57 N9 O7 P3

NMR

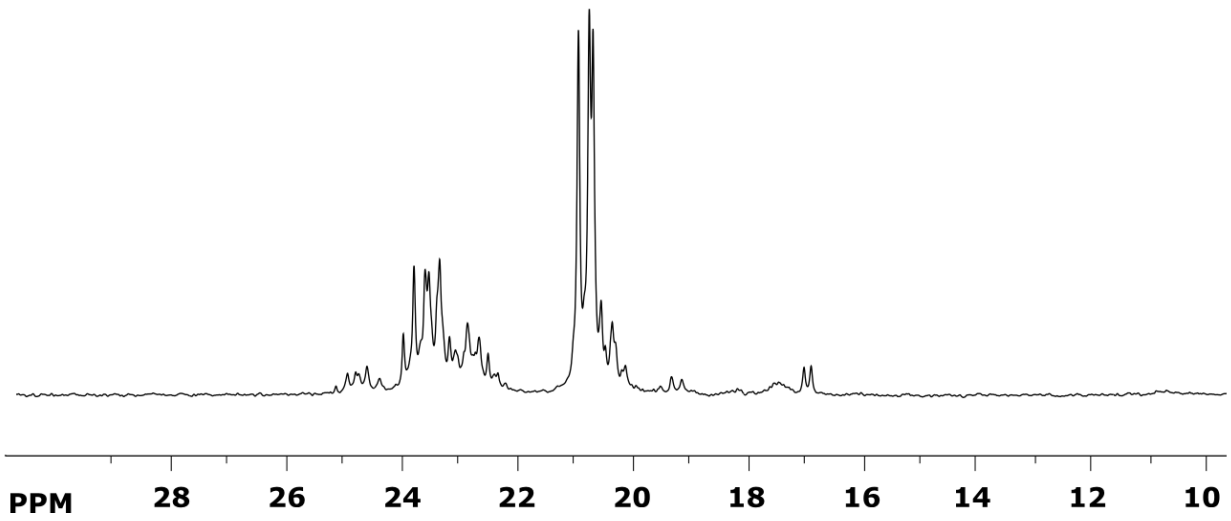

Figure SI 2 - ^{31}P NMR spectra (D_2O, 600 MHz, 27 ^{o}C)

FTIR

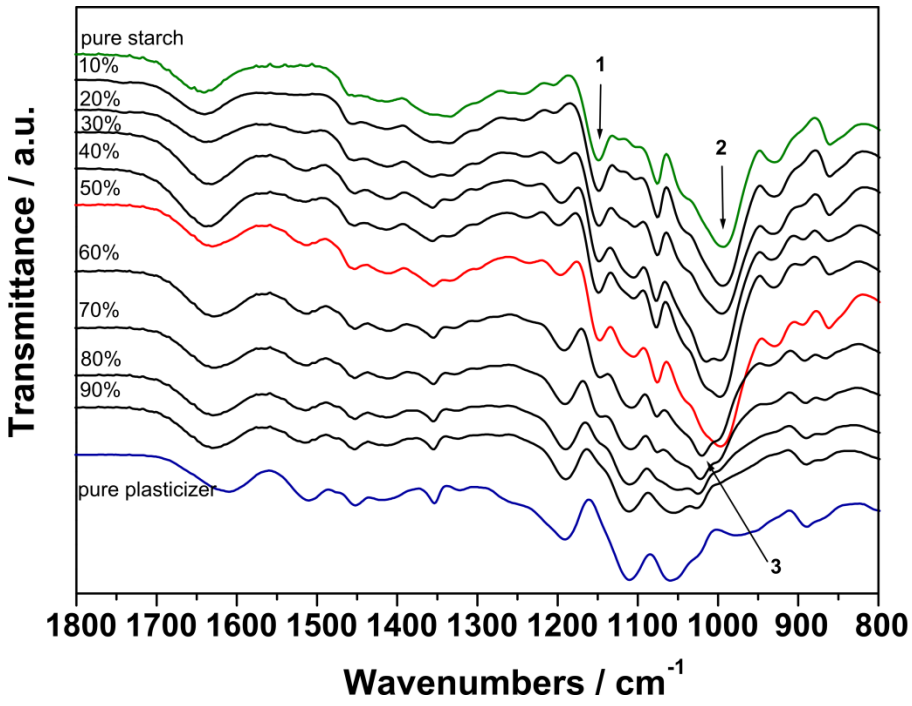

Figure SI 3 – FTIR spectra of the whole series of starch/AEEP films

Table SI 2 – FTIR bands observed in spectra of fresh dried starch/AEEP films

Sample	FTIR Bands									
0%	3278	1640		1149		1075		993	929	761
10%	3268	1640		1149		1075		994	930	762
20%	3270	1640		1149		1075		995	932	760
30%	3270	1630	1198	1148		1076		996	924	761
40%	3270	1630	1202	1148		1075		996	930	762
50%	3259	1630	1194	1148		1075		1000	935	758
60%	3270	1630	1195	1146	1104	1076		997	931	758
70%	3255	1626	1196		1107		1021		939	758
80%	3269	1629	1195		1110		1024			756
90%	3270	1626	1197		1110		1026			755
100%	3255	1609	1191		1110		1059			754

DSC

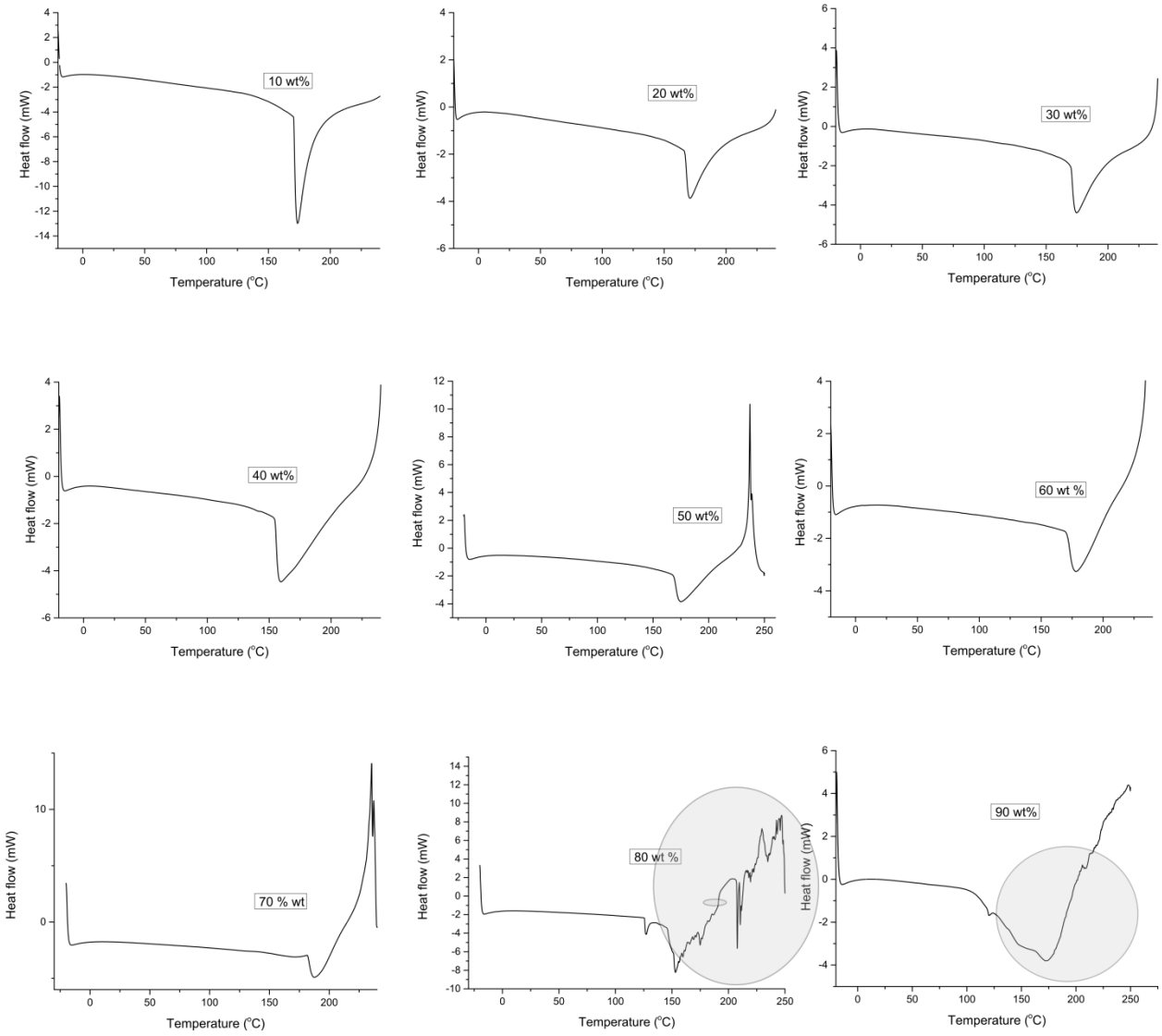

Figure SI 4 – DSC curves of the whole series of starch/AEEP films

TGA

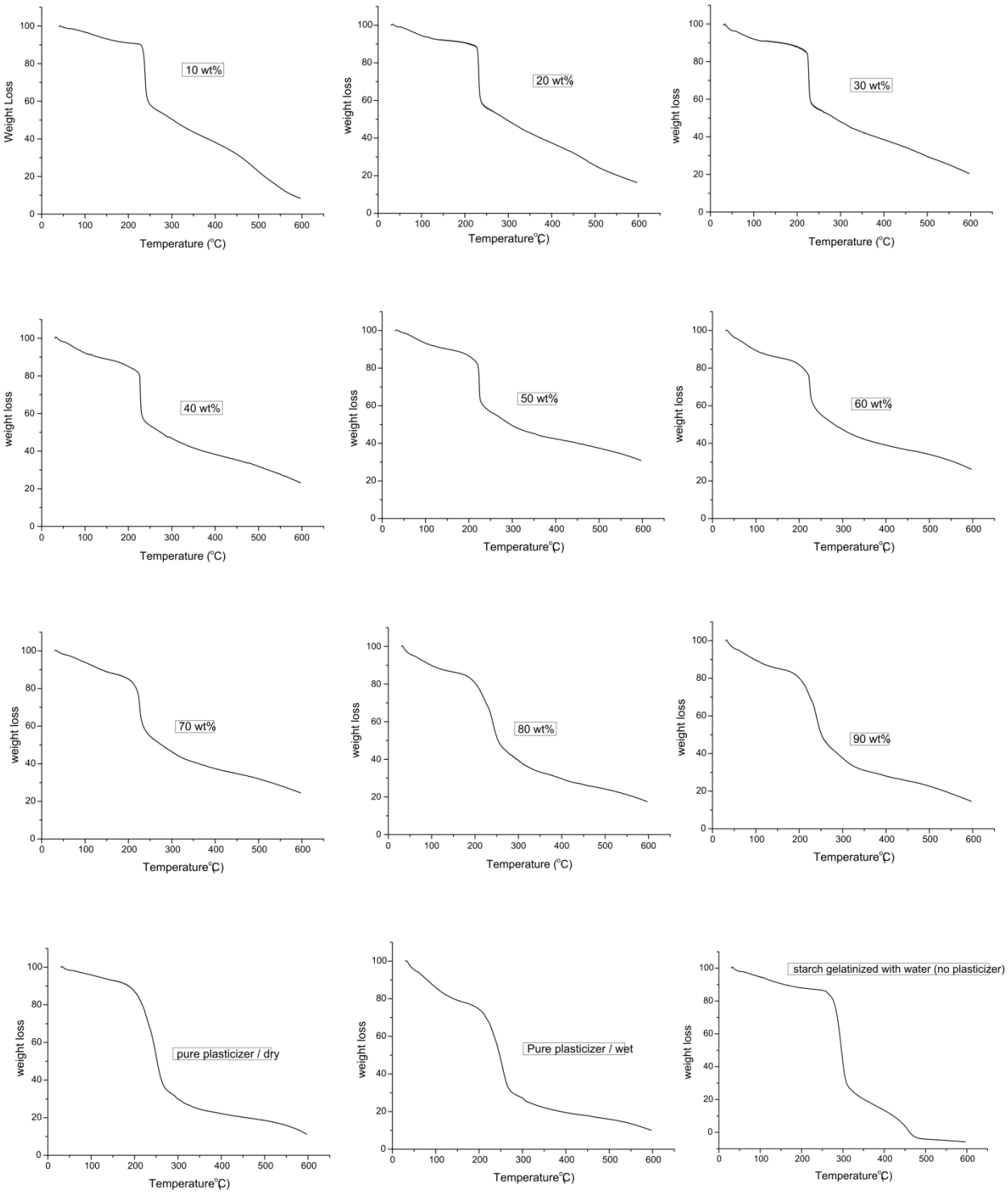

Figure SI 5 – TGA curves of the whole series of starch/AEEP films

Mechanical Tests

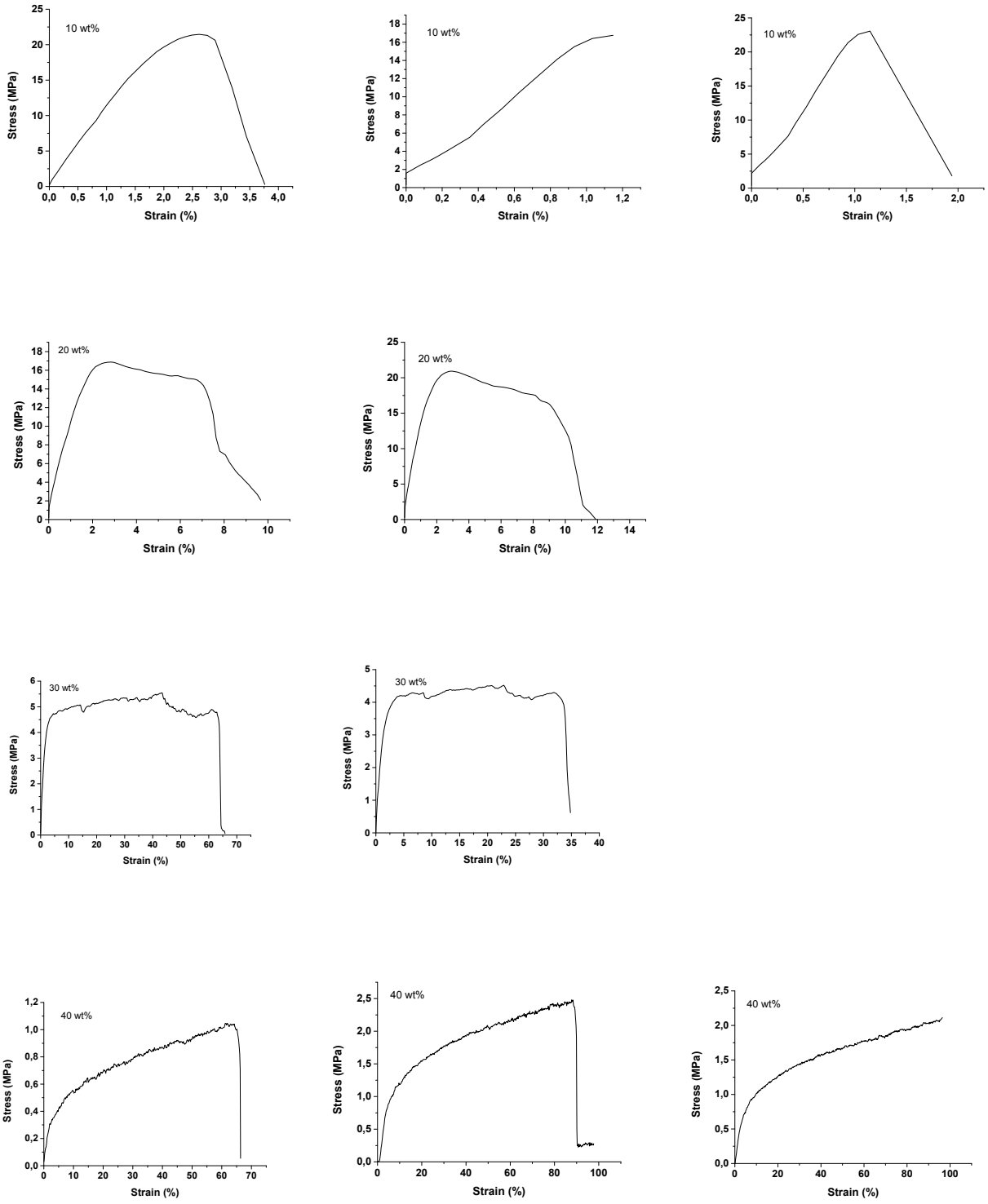

Figure SI6 - Stress-strain curves for the films containing 10, 20, 30 and 40 wt% AEEP