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APPENDICES

Appendix - A

Data from dynamic light scattering

(1) PAM (PS - 19901) in water

C_{PAM} (g/l)	$D \times 10^{12}$ (m ² /sec)	τ_q (μs)	R_H (nm)
0.2	7.70	246.24	36.06 ± 0.45
0.4	8.30	229.70	33.65 ± 0.55
0.6	8.34	227.88	33.38 ± 0.88
0.8	8.40	225.46	33.05 ± 1.03
1.0	8.70	217.30	31.80 ± 0.37
1.6	8.97	211.50	30.97 ± 0.37
2.0	9.40	200.60	29.85 ± 0.82
2.5	9.80	193.30	28.30 ± 0.25
3.0	9.90	191.60	28.05 ± 0.65
3.5	10.40	182.10	26.65 ± 0.86
4.0	10.30	184.00	26.95 ± 0.53
5.0	12.60	151.20	22.15 ± 1.84

(2) PAM (PS - 02806) in water

C_{PAM} (g/l)	$D \times 10^{12}$ (m^2/sec)	τ_q (μs)	R_H (nm)
0.2	5.20	363.13	53.19 ± 0.66
0.4	5.57	340.80	49.90 ± 1.36
0.6	5.50	344.23	50.40 ± 0.65
0.8	5.27	361.00	52.85 ± 0.85
1.0	5.37	352.43	51.60 ± 1.64
1.6	5.63	335.70	49.17 ± 1.35
2.0	5.93	321.50	47.09 ± 1.65

(3) Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	$D \times 10^{11}$ (m^2/sec)	τ_q (μs)	R_H (nm)
10	5.75	33.00	4.85 ± 0.22
20	5.37	35.30	5.15 ± 0.35
30	5.25	36.21	5.30 ± 0.41
40	5.34	35.50	5.20 ± 0.64
50	5.19	36.57	5.35 ± 0.05

Effect of surfactant concentration on complex solution

(4) 0.4 g/l PAM (PS - 19901) / Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	$D \times 10^{12}$ (m ² /sec)	τ_q (μ s)	R_H (nm)
0.001	7.80	242.00	35.43 \pm 1.89
0.003	7.63	248.73	36.45 \pm 2.70
0.005	7.60	249.90	36.60 \pm 2.41
0.007	7.37	258.00	37.80 \pm 2.31
0.01	7.63	247.95	36.32 \pm 1.26
0.02	7.38	257.22	37.65 \pm 2.38
0.04	7.46	254.78	37.31 \pm 0.86
0.06	7.34	258.06	37.79 \pm 0.95
0.08	6.84	278.70	40.80 \pm 0.83
0.10	6.83	281.30	41.20 \pm 2.28
0.15	6.67	284.93	41.74 \pm 0.15
0.20	6.20	305.03	44.65 \pm 1.33
0.25	5.97	318.57	46.65 \pm 1.05
0.30	5.90	323.50	47.40 \pm 0.80
0.40	5.45	347.70	50.90 \pm 1.08
0.60	5.00	378.40	55.40 \pm 1.50
1	6.20	306.73	44.90 \pm 1.39
5	10.80	176.37	25.85 \pm 2.20
10	24.90	76.70	11.24 \pm 1.00
30	38.95	48.70	7.13 \pm 1.74
50	51.70	36.60	5.35 \pm 0.24

(5) 1.0 g/l PAM (PS - 19901) / Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	$D \times 10^{12}$ (m ² /sec)	τ_q (μs)	R_H (nm)
0.001	7.70	246.73	36.15 ± 0.90
0.003	7.93	239.43	35.05 ± 0.45
0.005	7.77	244.00	35.75 ± 2.41
0.007	7.57	250.07	36.62 ± 2.15
0.01	7.63	249.70	36.55 ± 1.92
0.02	7.90	240.40	35.20 ± 1.23
0.04	7.70	245.80	36.00 ± 0.97
0.06	7.33	258.83	37.90 ± 2.92
0.08	6.57	288.90	42.30 ± 2.48
0.1	5.87	322.23	47.19 ± 2.00
0.2	5.43	349.37	51.15 ± 2.16
0.3	5.33	356.20	52.17 ± 1.39
0.4	4.87	391.60	57.35 ± 1.28
1	5.97	318.37	46.64 ± 2.64
5	10.20	186.30	27.30 ± 2.92
10	20.00	95.80	14.00 ± 1.23
30	33.78	56.20	8.23 ± 0.08
50	50.93	37.20	5.44 ± 0.50

Effect of polymer concentration on complex solution

(6) PAM (PS - 19901) / 0.1 mM Triton X - 100 solution

C_{PAM} (g/l)	$D \times 10^{12}$ (m ² /sec)	τ_q (μs)	R_H (nm)
0.2	6.03	219.40	32.00 ± 2.88
0.4	6.67	215.67	31.65 ± 2.28
0.6	6.40	213.30	31.25 ± 0.15
0.8	7.00	213.00	31.18 ± 2.60
1.0	5.87	212.47	31.10 ± 1.25

(7) PAM (PS - 19901) / 5 mM Triton X - 100 solution

C_{PAM} (g/l)	$D \times 10^{12}$ (m ² /sec)	τ_q (μs)	R_H (nm)
0.2	14.47	53.40	7.82 ± 0.66
0.4	10.80	63.04	9.23 ± 2.20
0.6	10.63	74.16	10.86 ± 0.43
0.8	10.40	76.68	11.12 ± 0.96
1.0	10.20	86.42	12.66 ± 0.65
1.6	9.03	111.18	16.27 ± 1.38
2.0	7.93	114.88	16.82 ± 0.60
3.0	7.07	131.16	19.21 ± 1.09
4.0	6.40	133.20	19.50 ± 1.06

(8) PAM (PS - 19901) / 10 mM Triton X - 100 solution

C_{PAM} (g/l)	$D \times 10^{12}$ (m ² /sec)	τ_q (μ s)	R_H (nm)
0.2	26.97	71.87	10.54 \pm 1.70
0.4	24.90	76.70	11.24 \pm 1.00
0.6	23.70	80.00	11.70 \pm 1.45
0.8	21.60	87.97	12.90 \pm 0.79
1.0	20.00	95.80	14.00 \pm 1.23
1.6	14.96	126.63	18.54 \pm 0.40
2.0	11.60	163.50	23.94 \pm 0.82
3.0	11.30	168.97	24.74 \pm 0.45
4.0	10.67	180.00	26.37 \pm 0.30
5.0	9.60	198.00	29.00 \pm 0.30

(9) PAM (PS - 19901) / 50 mM / Triton X - 100 solution

C_{PAM} (g/l)	$D \times 10^{12}$ (m ² /sec)	τ_q (μ s)	R_H (nm)
0.2	52.10	36.37	5.32 \pm 1.19
0.4	51.70	36.60	5.35 \pm 0.24
0.6	49.84	38.04	5.57 \pm 0.46
0.8	49.67	38.20	5.60 \pm 0.25
1.0	50.93	37.20	5.44 \pm 0.50
1.6	49.90	38.00	5.55 \pm 0.45
2.0	50.90	37.23	5.45 \pm 0.08
3.0	48.58	39.04	5.70 \pm 0.13

Effect of polymer molecular weight on complex solution

(10) 0.4 g/l PAM (PS - 19901) / Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	$D \times 10^{12}$ (m ² /sec)	τ_q (μ s)	R_H (nm)
0.001	7.80	242.00	35.43 \pm 1.89
0.005	7.60	249.00	36.60 \pm 2.41
0.01	7.63	247.95	36.32 \pm 1.26
0.04	7.46	254.78	37.31 \pm 0.86
0.08	6.84	281.08	41.17 \pm 0.83
0.1	6.67	284.93	41.74 \pm 2.28
0.2	6.20	305.03	44.65 \pm 1.33
0.4	5.45	347.70	50.90 \pm 1.08
1	6.20	306.73	44.90 \pm 1.39
5	10.80	176.37	25.85 \pm 2.20
10	24.90	76.70	11.24 \pm 1.10
20	38.50	49.20	7.20 \pm 1.77
30	38.95	48.70	7.13 \pm 1.74
40	45.50	41.65	6.10 \pm 0.87
50	51.70	36.60	5.35 \pm 0.24

(11) 0.4 g/l PAM (PS - 02806) / Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	$D \times 10^{12}$ (m ² /sec)	τ_q (μs)	R_H (nm)
0.005	5.53	343.27	50.27 ± 1.08
0.01	5.17	366.40	53.65 ± 2.22
0.02	5.00	378.45	55.40 ± 1.34
0.06	4.85	390.95	57.25 ± 2.09
0.1	4.40	429.50	62.90 ± 0.80
0.2	4.30	438.70	64.25 ± 0.78
0.3	4.30	439.00	64.29 ± 1.59
0.4	3.87	487.37	71.37 ± 1.95
1	4.13	459.10	67.24 ± 3.09
5	10.23	185.47	27.17 ± 1.25
10	20.73	91.43	13.39 ± 1.05
20	30.83	65.23	9.55 ± 0.72
30	38.20	49.70	7.25 ± 0.63
40	43.25	44.30	6.48 ± 0.52
50	50.18	37.76	5.52 ± 0.19

Appendix - B

Data from static light scattering measurement

(1) 0.1g/l PAM (PS - 19901) in water (2) 0.4 g/l PAM (PS - 19901) in water

Angle (Degree)	$Kc / R \times 10^3$
40	0.00211
50	0.00257
60	0.00228
70	0.00268
80	0.00283
90	0.00290
100	0.00304

Angle (Degree)	$Kc / R \times 10^3$
40	0.00282
50	0.00302
60	0.00382
70	0.00389
80	0.00430
90	0.00465
100	0.00483

(3) 0.8 g/l PAM (PS - 19901) in water (4) 1.5 g/l PAM (PS - 19901) in water

Angle (Degree)	$Kc / R \times 10^3$
40	0.00442
50	0.00484
60	0.00480
70	0.00507
80	0.00530
90	0.00551
100	0.00570

Angle (Degree)	$Kc / R \times 10^3$
40	0.00584
50	0.00622
60	0.00622
70	0.00644
80	0.00689
90	0.00703
100	0.00733

(5) 0.15 g/l PAM (PS - 02806) in water (6) 0.4 g/l PAM (PS - 02806) in water

Angle (Degree)	$Kc / R \times 10^3$
30	0.00123
40	0.00126
50	0.00159
60	0.00186
70	0.00209
80	0.00269
90	0.00279

Angle (Degree)	$Kc / R \times 10^3$
30	0.00246
40	0.00224
50	0.00265
60	0.00300
70	0.00327
80	0.00394
90	0.00415

(7) 0.8 g/l PAM (PS - 02806) in water (8) 1.2 g/l PAM (PS - 02806) in water

Angle (Degree)	$Kc / R \times 10^3$
30	0.00333
40	0.00307
50	0.00353
60	0.00397
70	0.00438
80	0.00519
90	0.00620

Angle (Degree)	$Kc / R \times 10^3$
30	0.00415
40	0.00392
50	0.00439
60	0.00476
70	0.00513
80	0.00591
90	0.00620

Appendix - C***Data from refractive index measurement***

(1) PAM in aqueous solution

C_{PAM} (g/l)	$\Delta n \times 10^6$	$\Delta n \times 10^6$
	PS - 19901	PS - 02806
0.2	44.5	37.0
0.4	83.5	71.4
0.6	120.0	109.0
0.8	154.0	143.0
1.0	185.0	176.0

Appendix - D***Data from viscosity measurement***

(1) PAM (PS - 19901) in water

C_{PAM} (g/l)	η (cP)	η_{sp}	η_{sp} / c (l/g)
0.2	0.84129	0.05161	0.25807
0.4	0.88444	0.10555	0.26387
0.6	0.93017	0.16271	0.27118
0.8	0.97802	0.22253	0.27816
1.0	1.02529	0.28161	0.28161
1.6	1.15586	0.44482	0.27801
2.0	1.26464	0.58080	0.29040
3.0	1.67138	1.08923	0.36308
4.0	2.04383	1.55479	0.38870

(2) PAM (PS - 02806) in water

C_{PAM} (g/l)	η (cP)	η_{sp}	η_{sp} / c (l/g)
0.2	0.90989	0.13736	0.68678
0.4	1.02658	0.28323	0.70807
0.6	1.16344	0.45430	0.75716
0.8	1.33020	0.66275	0.82843
1.0	1.42083	0.77603	0.77603
1.5	1.73186	1.16482	0.77655
2.0	2.16699	1.70873	0.85347

(3) Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	η (cP)	η_{sp}
0.01	0.80763	0.00954
0.02	0.80847	0.01058
0.04	0.80788	0.00986
0.06	0.80714	0.00892
0.08	0.80843	0.01053
0.1	0.80647	0.00809
0.2	0.80597	0.00746
0.3	0.80807	0.01009
0.4	0.80884	0.01105
1	0.80993	0.01241
5	0.81959	0.02449
10	0.83122	0.03903
20	0.85295	0.06619
30	0.89318	0.11648
40	.93896	0.17369
50	0.96365	0.20457

Effect of surfactant concentration on complex solution

(4) 0.4 g/l PAM (PS - 19901) / Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	η (cP)	η_{sp}
0.001	0.83683	0.04604
0.003	0.83633	0.04542
0.005	0.83463	0.04328
0.007	0.83350	0.04188
0.009	0.83134	0.03917
0.01	0.82909	0.03636
0.02	0.82726	0.03408
0.04	0.82630	0.03287
0.06	0.82509	0.03136
0.08	0.82242	0.02803
0.1	0.81997	0.02496
0.2	0.81972	0.02465
0.3	0.81568	0.01960
0.4	0.81597	0.01996
1	0.81593	0.01991
5	0.82451	0.03063
10	0.83334	0.04167
20	0.85374	0.06718
30	0.87940	0.09925
40	0.90518	0.13147
50	0.93167	0.16458

(5) 1.0 g/l PAM (PS - 19901) / Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	η (cP)	η_{sp}
0.001	0.88656	0.10820
0.003	0.88556	0.10695
0.005	0.87819	0.09774
0.007	0.87702	0.09628
0.009	0.87628	0.09534
0.01	0.87573	0.09467
0.02	0.87536	0.09420
0.04	0.87240	0.09050
0.06	0.87003	0.08754
0.08	0.85832	0.07291
0.1	0.85799	0.07249
0.2	0.85770	0.07213
0.3	0.85774	0.07218
0.4	0.85766	0.07207
1	0.85828	0.07285
5	0.86566	0.08207
10	0.87948	0.09935
20	0.89685	0.12106
30	0.92275	0.15344
40	0.94937	0.18671
50	0.97894	0.22367

(6) PAM (PS - 19901) / Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	$\eta - (\eta_{\text{sol}} + \eta_{\text{surfactant}})$	$\eta - (\eta_{\text{sol}} + \eta_{\text{surfactant}})$
	0.4 g/l	1.0 g/l
0.01	0.02146	0.06810
0.02	0.01879	0.06689
0.04	0.01842	0.06452
0.06	0.01795	0.06289
0.08	0.01399	0.05281
0.1	0.01350	0.05152
0.2	0.01375	0.05173
0.3	0.00761	0.04967
0.4	0.00713	0.04882
1	0.00600	0.04835
5	0.00492	0.04607
10	0.00212	0.04826
20	0.00079	0.04390
30	-	0.02957
40	-	0.01041

(7) 0.4 g/l PAM (PS - 02806) / Triton X - 100 in water

$C_{\text{surfactant}}$ (mM)	η (cP)	η_{sp}
0.005	0.87990	0.09987
0.01	0.87832	0.09789
0.02	0.87807	0.09758
0.06	0.87390	0.09238
0.1	0.87369	0.09212
0.2	0.87244	0.09055
0.3	0.86911	0.08639
0.4	0.86882	0.08603
1	0.87332	0.09165
5	0.87963	0.09954
10	0.88970	0.11212
20	0.90256	0.12819
30	0.91784	0.14730
40	0.95291	0.19113
50	0.97765	0.22206

Effect of polymer concentration on complex solution

(8) PAM (PS - 19901) / Triton X - 100 solution

C_{PAM} (g/l)	η (cP)	η (cP)	η (cP)	η (cP)
	0.1 mM	5 mM	10 mM	50 mM
0.2	0.80472	0.81226	0.82184	0.91742
0.4	0.81997	0.82451	0.83334	0.93167
0.6	0.82971	0.83817	0.84725	0.94749
0.8	0.84271	0.85641	0.86445	0.96265
1.0	0.85799	0.86566	0.87948	0.97894
1.6	0.90389	0.91051	0.92175	1.02350
2.0	0.93487	0.94474	0.95070	1.05224
3.0	1.05141	1.04153	1.07310	1.16852
4.0	1.14153	1.12995	1.17956	1.25119

(9) PAM (PS - 19901) / Triton X - 100 solution

C_{PAM} (g/l)	η_{sp}	η_{sp}	η_{sp}	η_{sp}
	0.1 mM	5 mM	10 mM	50 mM
0.2	0.00590	0.01533	0.02730	0.14678
0.4	0.02496	0.03063	0.04167	0.16458
0.6	0.03714	0.04771	0.05906	0.18437
0.8	0.05338	0.07051	0.08056	0.20332
1.0	0.07249	0.08207	0.09935	0.22367
1.6	0.12986	0.13814	0.15220	0.27938
2.0	0.16859	0.18093	0.18838	0.31530
3.0	0.31426	0.30192	0.34138	0.46065
4.0	0.42691	0.41244	0.47445	0.56399

Appendix - E

Surface tension measurement

(1) 0.4 g/l PAM / Triton X - 100 in aqueous solution

$C_{\text{surfactant}}$ (mM)	γ (mN/m)	γ (mN/m)
	Pure Triton X - 100	Complex
0	55.9	-
0.02	43.0	39.3
0.06	35.9	36.9
0.10	33.5	36.1
0.16	31.4	33.7
0.18	30.6	30.5
0.2	30.6	30.7
0.4	30.6	30.4
0.6	30.8	29.6
0.8	30.8	29.8
1.0	30.8	29.6
1.5	30.9	29.9
2.0	31.0	30.0

CURRICULUM VITAE

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