REFERENCES

Almusallam, A.S., Larson, R.G., and Solomon, M.J. (2000). A constitutive model for the prediction of ellipsoidal droplet shapes and stresses in immiscible blends. Journal of Rheology, 44(5), 1055-1083.

Bartram, E., Goldsmith, H.L., and Mason, S.G. (1975). Particle motions in non-Newtonian media. Rheologica Acta, 14, 776-782.

Branrup, J. and Immergut, E.H. (1989). Polymer Handbook. New York: John Wiley & Sons.

Bentley, B.J. and Leal, L.G. (1986). An experimental investigation of drop deformation and breakup in steady, two-dimensional linear flows. Journal of Fluid Mechanics, 167, 241-283.

Grace, H. P. (1982). Dispersion phenomena in high viscosity immiscible fluid systems and application of static mixers as dispersion devices in such systems, Chemical Engineering Communications, 14, 225-227.

Graebling, D., Muller, R., and Palierne J. F. (1993). Linear viscoelastic behavior of some incompatible polymer blends in the melt. Interpretation of data with a model of emulsions of viscoelastic liquids. Macromolecules, 26, 320-329.

Guido, S. and Villone, M. (1998). Three-dimensional shape of a drop under simple shear flow. Journal of Rheology, 42(2), 395-415.

Hobbie, E.K. and Migler, K.B. (1999). Vorticity elongation in polymeric emulsions. Physical Review Letters, 82(26), 5393-5396.

Larson, R.G. (1999). The structure and rheology of complex fluids. New York: Oxford University Press.

Lerdwijitjarud, W., Sirivat, A., and Larson, R.G. (2002). Influence of elasticity on dispersed-phase droplet size in immiscible polymer blends in simple shearing flow. Polymer Engineering and Science, 42(4), 798-809.

Lerdwijitjarud, W., Larson, R.G., Sirivat, A., and Solomon M. J. (2003). Influence of weak elasticity of dispersed phase on droplet behavior in sheared polybutadiene/poly(dimethylsiloxane) blends. Journal of Rheology, 47, 37-57.

Levitt, L., Macosko, C.W. and Pearson, S.D. (1996). Influence of normal stress difference on polymer drop deformation. Polymer Engineering Science, 36(12), 1647-1655.

Luciani, A., Champagne, M.F., and Utracki, L.A. (1997). Interfacial tension coefficient from the retraction of ellipsoidal drops. Journal of Polymer Science: Polymer Physics, 35, 1393-1403.

Mighri, F., Ajji, A., and Carreau, P.J. (1997). Influence of elastic properties on drop deformation in elongational flow. Journal of Rheology, 41(5), 1183-1201.

Mighri, F., Carreau, P.J., and Ajji, A. (1998). Influence of elastic properties on drop deformation and in shear flow. Journal of Rheology, 42(6), 1477-1490.

Mighri, F. and Huneault, M.A. (2001). Dispersion visualization of model fluids in a transparent Couette flow cell. Journal of Rheology, 45(3), 783-797.

Migler, K.B. (2000). Droplet vorticity alignment on model polymer blends. Journal of Rheology, 44(2), 277-290.

Palierne, J. F. (1990). Linear rheology of viscoelastic emulsions with interfacial tension, Rheologica Acta, 29, 204-214.

Rumscheidt, F.D. and Mason, S.G. (1961). Particle Motions in Sheared Suspensions. XII. Deformation and burst of fluid drops in shear and hyperbolic flow. Journal of Colloid Sciences, 16, 238-261.

Taylor, G.I. (1932). The viscosity of a fluid containing small drops of another fluid. Proceedings of the Royal Society of London, Series A, 138(834), 41-48.

Taylor, G.I. (1934). The formation of emulsions in definable fields of flow. Proceedings of the Royal Society of London, Series A, 146(858), 501-523.

Tsakalos, V.T., Navard, P., and Peurel-Disdier, E. (1998). Deformation and breakup mechanisms of single drops during shear. Journal of Rheology, 42(6), 1403-1417.

Wu, S. (1987). Formation of Dispered phase in incompatible polymer blends-interfacial and rheological effects. Polymer Engineering and Science, 27, 335-343.

Yamane, H., Takahashi, M., Hayashi, R., and Okamoto K. (1998). Observation of deformation and recovery of poly(isobutylene) droplet in a poly(isobutylene)/poly(dimethyl siloxane) blend after application of step shear strain. Journal of Rheology, 42(3), 567-580.

APPENDIX A

Rheological Characterization

The shear rate (or frequency) dependence of viscosity, N_1, and storage modulus of all polymers; i.e., HDPE1 at 147°C, PS1 at 147°C, HDPE2 at 139°C, and PS2 at 139°C are shown in Table A1, A2, A3 and A4, respectively.

Table A1 Viscosity, N_1, and G' vs. shear rate and oscillation frequency of HDPE1 at 147°C

Shear Rate (s^{-1})	η (Pa·s)						N_1 (Pa)						G' (Pa)					
	1	2	3	4	5	Avg	1	2	3	4	5	Avg	1	2	3	4	5	Avg
0.0100	-	3103	3157	3318	3094	3168	-	-	-	-	-	-	-	-	-	-	-	-
0.0126	-	3831	3841	3981	3787	3860	-	-	-	-	-	-	-	-	-	-	-	-
0.0159	-	3094	3128	3243	3127	3148	-	-	-	-	-	-	-	-	-	-	-	-
0.0200	-	3208	3192	3314	3241	3239	-	-	-	-	-	-	-	-	-	-	-	-
0.0251	-	3155	3116	3231	3150	3163	-	-	-	-	-	-	-	-	-	-	-	-
0.0316	-	2960	2944	3033	2941	2970	-	-	-	-	-	-	-	-	-	-	-	-
0.0398	-	3041	3026	3104	3036	3051	-	-	-	-	-	-	-	-	-	-	-	-
0.0501	-	2970	2959	3035	2959	2981	-	-	-	-	-	-	19	24	23	-	-	21.8
0.0631	-	3008	2991	3049	2978	3006	-	-	-	-	-	-	28	27	28	-	-	27.6
0.0794	-	2881	2855	2903	2844	2870	-	-	-	-	-	-	36	36	35	36	-	35.9
0.1000	-	2806	2776	2818	2767	2792	-	-	-	-	-	-	44	44	45	46	44	44.6
0.1259	-	2821	2782	2825	2785	2803	-	-	-	-	-	-	58	58	59	57	57	57.7
0.1585	-	2685	2659	2690	2658	2673	-	-	-	-	-	-	72	75	75	74	71	73.5
0.1995	-	2654	2625	2675	2646	2650	-	-	-	-	-	-	95	94	95	92	93	93.8
0.2512	-	2565	2521	2571	2537	2548	-	502	444	228	191	341	122	121	122	121	120	121
0.3162	-	2511	2494	2528	2494	2507	-	421	741	465	272	475	153	153	154	152	151	153
0.3981	-	2404	2396	2428	2390	2405	-	463	589	575	730	589	195	195	198	194	192	195
0.5012	-	2321	2315	2363	2327	2331	-	1126	654	943	613	834	249	247	251	247	245	248

Table A1 Viscosity, N_1, and G' vs. shear rate and oscillation frequency of HDPE1 at 147°C (cont.)

Shear Rate (s^{-1})	η (Pa·s)						N_1 (Pa)						G' (Pa)					
	1	2	3	4	5	Avg	1	2	3	4	5	Avg	1	2	3	4	5	Avg
0.6310	-	2249	2262	2285	2253	2262	-	957	1126	874	858	954	315	313	319	313	311	314
0.7943	-	2158	2163	2204	2174	2175	1041	1663	1349	1558	1187	1359	402	398	405	398	396	400
1.0000	-	2088	2102	2117	2095	2101	1392	1347	1491	2200	1608	1608	507	502	514	505	499	505
1.2590	2085	2019	2048	2064	2038	2051	2604	1699	2009	1768	2183	2053	630	624	636	617	625	626
1.5850	1994	1937	1977	1989	1972	1974	3410	2142	2689	2648	2442	2666	803	791	810	787	800	798
1.9950	1921	1854	1890	1917	1901	1897	4218	3268	3089	3338	2948	3372	1014	999	1020	984	1006	1004
2.5120	1835	1776	1792	1824	1806	1807	5339	3900	3927	3738	4360	4253	1284	1255	1293	1236	1264	1266
3.1620	1759	1677	1708	1722	1718	1717	5632	5566	5647	5270	4819	5387	1604	1570	1621	1555	1602	1590
3.9810	1651	1599	1626	1638	1634	1629	7070	6846	6202	6560	5968	6529	2018	1965	2029	1945	2003	1992
5.0120	1573	1525	1544	1550	1552	1549	8318	8138	8607	8115	7030	8042	2515	2460	2533	2425	2528	2492
6.3100	1484	1441	1460	1471	1470	1465	9416	9645	10153	12187	11926	10665	3142	3059	3166	3026	3160	3111
7.9430	1397	1358	1382	1387	1393	1383	13762	14729	12132	13039	12076	13147	3909	3797	3947	3766	3952	3874
10.0000	1316	1282	1300	1301	1300	1299	15179	15338	17472	15356	15381	15745	4838	4704	4889	4653	4909	4799
12.5900	1235	1193	1225	1220	1229	1221	21291	20996	18413	21455	21447	20720	5909	5723	6034	5727	5848	5848
15.8500	1154	1119	1142	1148	1144	1141	24835	24293	24196	25878	25698	24980	7303	7056	7420	7053	7212	7209
19.9500	1076	1035	1056	1070	1058	1059	29636	29447	30994	31449	31007	30507	9121	8663	9166	8774	8898	8924
25.1200	984	-	972	981	977	978	36064	-	35454	39509	36499	36881	11031	10513	11101	10601	10870	10823

Table A2 Viscosity, N_1, and G' vs. shear rate and oscillation frequency of PS1 at 147°C

Shear Rate (s^{-1})	η (Pa·s)						N1 (Pa)						G'					
	1	2	3	4	5	Avg	1	2	3	4	5	Avg	1	2	3	5	6	Avg
0.0100	-	2516	2485	2487	2527	2504	-	-	-	-	-	-	-	-	-	-	-	-
0.0126	-	3045	2957	2936	2967	2976	-	-	-	-	-	-	-	-	-	-	-	-
0.0159	-	2396	2361	2365	2378	2375	-	-	-	-	-	-	-	-	-	-	-	-
0.0200	-	2548	2459	2495	2488	2498	-	-	-	-	-	-	-	-	-	-	-	-
0.0251	-	2539	2460	2466	2497	2490	-	-	-	-	-	-	-	-	-	-	-	-
0.0316	-	2395	2341	2351	2373	2365	-	-	-	-	-	-	-	-	-	-	-	-
0.0398	-	2506	2452	2449	2472	2470	-	-	-	-	-	-	-	-	-	-	-	-
0.0501	-	2487	2442	2440	2458	2457	-	-	-	-	-	-	-	-	-	-	-	-
0.0631	-	2555	2510	2502	2523	2522	-	-	-	-	-	-	6.2	-	-	-	6.0	6.1
0.0794	-	2499	2427	2438	2432	2449	-	-	-	-	-	-	8.8	-	-	-	8.1	8.4
0.1000	-	2481	2398	2424	2425	2432	-	-	-	-	-	-	11.9	11.2	12.7	13.3	12.5	12.3
0.1259	-	2554	2474	2489	2489	2502	-	-	-	-	-	-	18.1	16.8	18.7	16.7	18.3	17.7
0.1585	-	2497	2398	2411	2417	2431	-	-	-	-	-	-	25.9	24.6	27.1	27.9	27.5	26.6
0.1995	-	2522	2445	2436	2473	2469	-	-	-	-	-	-	39.2	37.1	41.8	41.4	39.4	39.8
0.2512	-	2479	2398	2416	2421	2428	-	-	-	-	-	-	57.5	55.0	60.4	58.3	60.1	58.2
0.3162	-	2476	2401	2414	2406	2424	-	-	-	-	-	-	84.7	81.1	89.2	87.1	86.1	85.6
0.3981	-	2416	2349	2364	2348	2369	-	-	-	-	-	-	123.4	118.4	129.8	127.1	125.7	125
0.5012	-	2407	2323	2323	2339	2348	-	-	-	-	-	-	176.5	171.7	186.4	182.1	179.8	179

Table A2 Viscosity, N_1, and G' vs. shear rate and oscillation frequency of PS1 at 147°C (cont.)

Shear Rate (s^{-1})	η (Pa·s)						N1 (Pa)						G'					
	1	2	3	4	5	Avg	1	2	3	4	5	Avg	1	2	3	5	6	Avg
0.6310	-	2349	2293	2287	2287	2304	-	-	-	-	-	-	252.5	245.4	261.9	256.2	258.1	255
0.7943	2342	2311	2231	2234	2238	2271	1069	-	-	892	847	936	356	345	370	362	363	359
1.0000	2285	2156	2212	2267	2166	2217	1393	1600	1173	1072	1168	1281	494	480	515	504	504	499
1.2590	2214	2103	2135	2187	2129	2154	1515	1781	1519	1441	1649	1581	661	649	691	673	677	670
1.5850	2154	2023	2079	2107	2063	2085	2419	2355	2302	2573	2331	2396	912	885	930	938	921	917
1.9950	2040	1945	1979	2017	1980	1992	3481	3233	3887	3294	3186	3416	1214	1177	1239	1212	1231	1215
2.5120	1939	1848	1895	1940	1886	1902	5811	4200	4542	4710	4154	4683	1602	1563	1642	1610	1615	1606
3.1620	1852	1748	1748	1817	1788	1791	6430	7779	6139	5595	6449	6478	2074	2052	2154	2112	2132	2105
3.9810	1715	1646	1655	1705	1684	1681	8902	8175	9849	10925	10250	9620	2682	2640	2755	2688	2717	2696
5.0120	1612	1527	1589	1607	1570	1581	11939	11932	10632	11858	12507	11773	3390	3368	3482	3442	3469	3430
6.3100	1524	1459	1487	1503	1479	1491	14424	13956	13551	16791	13860	14517	4268	4243	4374	4315	4347	4310
7.9430	1400	1362	1390	1404	1299	1371	20162	17971	22130	20640	17450	19671	5300	5255	5430	5324	5381	5338
10.0000	1291	1218	1254	1276	1217	1251	24419	25915	23584	24571	23502	24398	6502	6448	6633	6519	6608	6542
12.5900	1180	1126	1162	1182	-	1163	33229	29539	32994	31434	-	31799	7843	7945	8054	7895	7982	7944
15.8500	1075	1025	1057	1081	-	1060	40769	37402	39826	41085	-	39771	9425	9472	9719	9469	9671	9551
19.9500	984	-	949	985	-	973	49689	-	48662	50540	-	49630	11254	11776	11533	11220	11508	11458
25.1200	881	-	818	875	-	858	60827	-	58801	60079	-	59903	13237	13254	13623	13330	13605	13410

Table A3 Viscosity vs. shear rate and storage modulus vs. oscillation frequency of HDPE2 at 139°C

Shear Rate (s^{-1})	η (Pa·s)					G' (Pa)				
	1	2	3	4	Avg	1	2	3	4	Avg
0.0100	628	508	638	566	585	-	-	-	-	-
0.0126	706	690	703	687	697	-	-	-	-	-
0.0159	524	530	569	545	542	-	-	-	-	-
0.0200	567	548	625	575	579	-	-	-	-	-
0.0251	565	601	647	588	600	-	-	-	-	-
0.0316	538	559	607	569	568	-	-	-	-	-
0.0398	564	601	613	602	595	-	-	-	-	-
0.0501	567	604	618	597	596	-	-	-	-	-
0.0631	606	628	634	622	623	-	-	-	-	-
0.0794	606	609	629	596	610	1.5	1.1	-	-	1.3
0.1000	611	616	624	595	612	2.4	2.2	1.8	1.5	2.0
0.1259	636	634	645	612	632	2.2	2.2	2.3	2.4	2.3
0.1585	622	613	623	594	613	3.2	3.5	3.3	3.3	3.3
0.1995	627	629	634	612	625	3.6	4.0	3.6	3.4	3.7
0.2512	622	618	622	605	617	5.3	5.5	5.5	5.0	5.3
0.3162	627	631	619	606	621	7.5	7.4	6.9	7.2	7.2
0.3981	616	622	611	600	612	10.5	9.9	9.7	9.6	9.9
0.5012	614	618	610	601	611	13.9	13.5	13.5	13.6	13.6
0.6310	618	622	611	601	613	18.4	18.5	18.2	18.2	18.3
0.7943	610	612	605	596	606	25.7	25.6	24.6	24.5	25.1
1.0000	608	609	602	593	603	35.3	35.2	33.1	33.1	34.2
1.2590	605	606	600	590	600	47.4	42.7	43.4	46.4	45.0
1.5850	601	601	596	586	596	63.1	60.4	59.1	66.3	62.2
1.9950	595	596	591	583	591	88.3	86.3	83.7	90.4	87.2

Table A4 Viscosity vs. shear rate and storage modulus vs. oscillation frequency of PS2 at 139°C

Shear Rate (s^{-1})	η (Pa·s)					G' (Pa)				
	1	2	3	4	Avg	1	2	3	4	Avg
0.0100	588	602	651	638	620	-	-	-	-	-
0.0126	711	706	788	746	738	-	-	-	-	-
0.0159	538	596	603	594	583	-	-	-	-	-
0.0200	599	675	640	637	638	-	-	-	-	-
0.0251	625	627	630	640	630	-	-	-	-	-
0.0316	602	592	602	607	601	-	-	-	-	-
0.0398	637	630	628	626	630	-	-	-	-	-
0.0501	624	644	626	619	628	-	-	-	-	-
0.0631	637	663	642	647	647	-	1	-	1	-
0.0794	637	649	630	622	635	1.3	1.1	-	2	1.3
0.1000	634	651	627	619	633	1.7	1.6	1.5	2.3	1.8
0.1259	657	664	638	636	649	2.4	2.4	2.1	2.5	2.3
0.1585	643	640	624	614	630	2.9	2.8	3.4	3.5	3.2
0.1995	654	655	633	635	644	4.5	4.0	5.3	4.5	4.6
0.2512	652	643	623	625	636	6.3	6.1	6.0	7.1	6.4
0.3162	655	643	632	626	639	9.0	9.1	9.7	9.6	9.4
0.3981	644	638	624	618	631	13.0	13.2	13.9	14.4	13.6
0.5012	639	644	618	618	630	19.4	19.7	21.1	21.4	20.4
0.6310	644	638	619	620	630	29.0	29.4	30.6	31.8	30.2
0.7943	634	633	613	611	623	42.4	43.7	44.5	47.2	44.5
1.0000	629	625	611	609	619	62.3	64.4	63.0	69.2	64.7
1.2590	624	620	602	604	613	90.3	87.7	88.6	92.0	89.6
1.5850	615	612	595	597	604	132.0	129.2	128.7	134.2	131.0
1.9950	602	602	584	584	593	189.5	186.8	186.2	195.5	189.5

APPENDIX B

The stability of polymers at their experiment temperatures is confirmed by measuring the polymer viscosity under the constant shear rate of 0.5 s^{-1} , by a cone-plate rheometer, for 4 hours (include loading time). The results are shown in Fig B1.

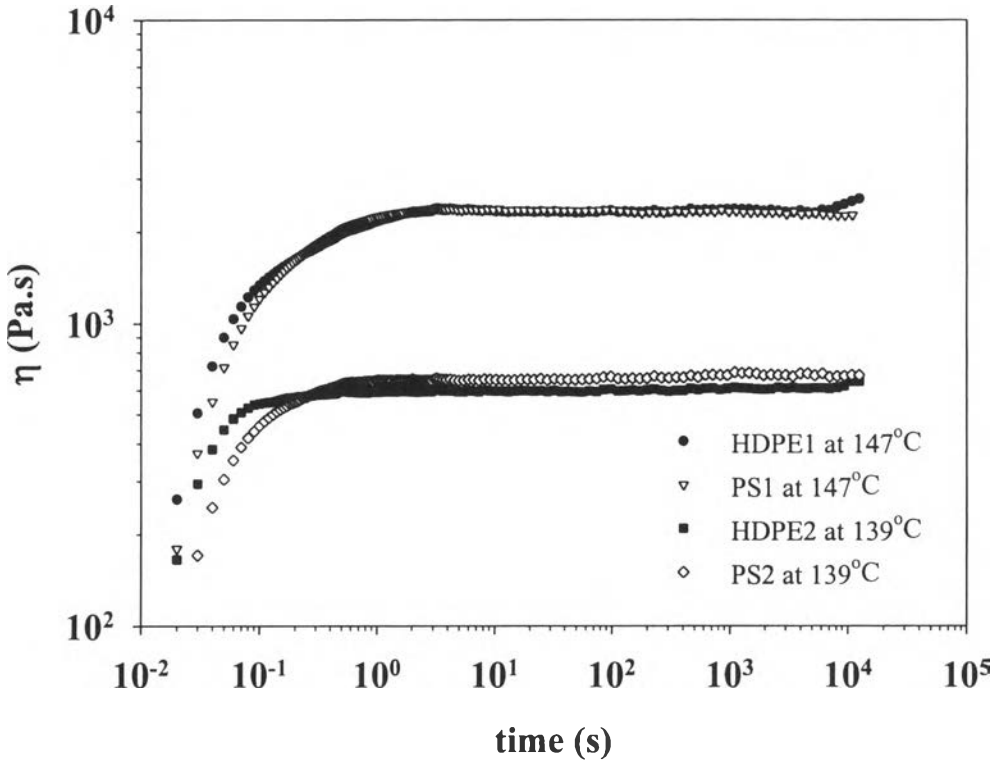


Figure B1 Stability of polymer viscosities at the constant shear rate of 0.5 s^{-1}

APPENDIX C

Calculation of Interfacial Tension

The interfacial tension in this study can be determined by measuring the deformation parameter Def. of a deformed retracting drop vs. time, which is known to decay exponentially [Lucinia *et al.* (1997)]:

$$Def = Def_o \exp\left(-\frac{t}{\tau}\right) \tag{1}$$

From Eq. 1, if a plot of ln Def vs time is constructed, the slope of the plot is $-1/\tau$, where t is the characteristic relaxation time, which can be related to the following equation [Palierne (1990) and Graebling et al. (1993)]:

$$\tau = \frac{(3+2\eta_r)(16+19\eta_r)r_o\eta_{m,o}}{40(1+\eta_r)\Gamma} \tag{2}$$

From test 1, the slope of the graph of ln (Def) vs. time is –0.00276

For system A;	η_r	(the zero shear viscosity ratio)	= 0.79	
	$\eta_{m,o}$	(the zero shear viscosity of matrix)	= 3150	Pa·s
In test 1;	r_o	(the initial droplet radius)	= 96	μm

By substituting all variables into Eq. 2, the obtained Γ is 1.66 mN/m.

The same procedure was repeated for 23 tests for system A at 147°C and 15 tests for system B at 139°C. Figure C1 shows the plots of ln Def vs time for the droplet size of 192 μm after application of 2% strain (shear rate of 0.2 s^{-1}). Figure 3 shows that the interfacial tension does not depend on the applied strain up to 7% strain. The interfacial tension values of system A and B are shown in Table C1 and Table C2, respectively.

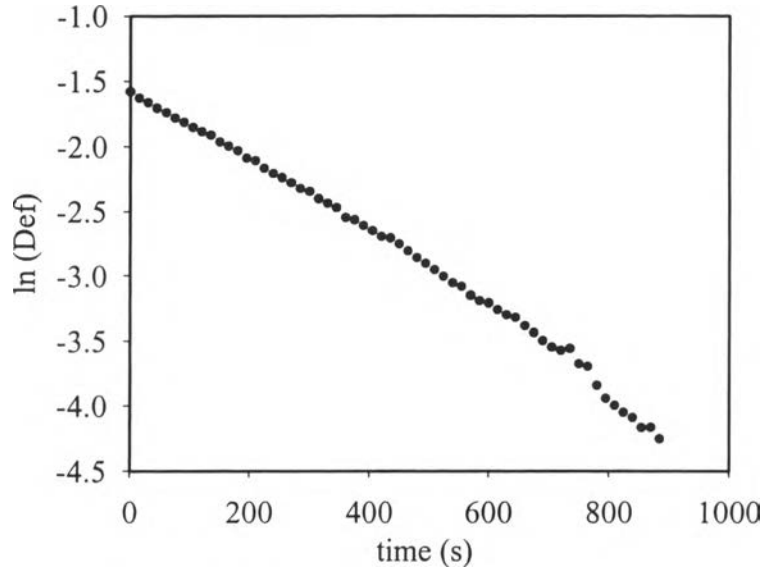


Figure C1 Semi-log plot of the relaxation shape vs. time after application of small shear strain, 2%, for system A (Shear rate of 0.2 s^{-1} and the initial droplet size of 192 μm).

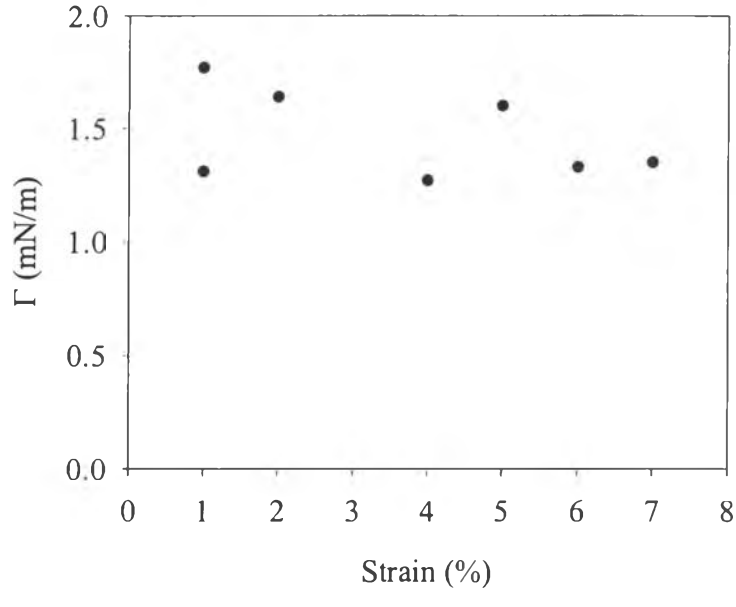


Figure C2 Dependence of the applied strain on the interfacial tension, for system A. (Initial droplet size of around 290±40 μm at shear rate of 1 s^{-1})

Table C1 Interfacial tension of system A (PS1/HDPE1 at 147°C)

Test	Initial Drop Diameter (μm)	Gap (μm)	Shear Rate (s^{-1})	Strain (%)	Γ (mN/m)
1	192.3	1200	0.2	2	1.66
2	192.3	1200	0.2	2	1.62
3	163.5	1100	0.1	2	1.50
4	163.5	1100	0.2	2	1.36
5	113.4	1000	0.2	2	0.75
6	153.2	1200	0.3	3	1.00
7	153	1200	0.3	3	1.20
8	143	1080	0.1	3	1.07
9	121	1250	0.2	2	0.91
10	121.6	1250	0.05	2	1.16
11	70.4	1380	0.2	2	0.78
12	336	2170	1	1	1.77
13	336	2170	1	2	1.64
14	201	2250	1	2	1.42
15	201	2250	2	2	1.22
16	416	2100	1	2	1.76
17	251	2050	1	4	1.27
18	251	2050	1	1	1.31
19	298	2220	1	5	1.6
20	298	2220	1	6	1.33
21	253	2220	1	7	1.35
22	369	2200	1	3	1.84
23	369	2200	1	2	1.82

Table C2 Interfacial tension of system B (PS2/HDPE2 at 139°C)

Test	Initial Drop Diameter (μm)	Gap (μm)	Shear Rate (s^{-1})	Strain (%)	Γ (mN/m)
1	175	1800	0.1	2	0.72
2	136	2000	0.1	3	0.66
3	116	1900	0.05	2	0.66
4	116	1900	0.05	3	0.56
5	126	1550	0.1	5	0.76
6	123	1550	0.2	6	0.71
7	178	1850	0.1	5	0.98
8	178	1850	0.1	6	0.75
9	368	2280	2	2	1.90
10	368	2280	2	2	2.40
11	368	2280	3	3	1.94
12	397	2200	2	2	2.60
13	393	2200	2	2	2.30
14	313	2200	2	2	2.30
15	375	2200	2	2	1.98

APPENDIX D

Raw Data in Transient Experiments

Table D1 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, $D_o \approx 75$ (±7) μm)

Test	Gap (μm)	D_o (μm)	time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a^*/D_o	c/D_o
1	1100	76.1	6	3	87.79	75.91	0.073	1.153	0.997
			10	5	93.14	76.78	0.096	1.224	1.009
			20	10	82.80	76.49	0.040	1.088	1.005
2	1280	68.4	4	2	76.68	68.74	0.055	1.121	1.005
			12	6	77.22	67.57	0.067	1.129	0.988
3	1200	73.6	8	4	89.61	73.45	0.099	1.217	0.997
			12	6	84.57	73.40	0.071	1.149	0.997
			16	8	79.04	72.79	0.041	1.073	0.989
4	1080	68.8	9	5	84.23	68.73	0.101	1.225	1.000
			14	7	78.20	68.41	0.067	1.137	0.995
5	830	70.6	16	8	76.13	70.53	0.038	1.078	0.999
			24	12	78.78	70.16	0.058	1.116	0.994
6	1130	85.2	26	13	98.79	85.23	0.074	1.160	1.000
			18	9	91.47	84.95	0.037	1.074	0.997
7	1200	76.2	28	14	92.33	77.59	0.087	1.211	1.018
			30	15	90.13	76.81	0.080	1.182	1.007
			32	16	87.68	76.28	0.070	1.150	1.001
8	1300	75.3	40	20	83.08	76.58	0.041	1.104	1.018
			50	25	82.08	76.73	0.034	1.091	1.020
			60	30	84.04	76.47	0.047	1.117	1.016
9	1280	73.6	70	35	84.27	76.82	0.046	1.145	1.044
			80	40	78.47	76.83	0.011	1.066	1.044
	1280	73.6	90	45	78.05	76.57	0.010	1.061	1.041

Table D1 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, $D_o \approx 75$ (±7) μm) (cont.)

Test	Gap (μm)	D_o (μm)	time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a^*/D_o	c/D_o
10	2400	70.3	81	41	77.51	72.86	0.031	1.103	1.037
			164	82	74.32	78.75	-0.029	1.058	1.121
			246	123	73.56	83.44	-0.063	1.047	1.187
			407	204	72.15	88.65	-0.103	1.027	1.261
			487	244	70.84	89.67	-0.117	1.008	1.276
			708	354	72.34	89.79	-0.108	1.029	1.278
			973	487	76.01	81.85	-0.037	1.082	1.165
			1110	555	76.05	78.99	-0.019	1.082	1.124
			1250	625	77.00	76.92	0.001	1.096	1.095
			1387	694	79.54	74.80	0.031	1.132	1.064
			1527	764	79.67	69.78	0.066	1.134	0.993
			1672	836	79.61	68.57	0.075	1.133	0.976
			1820	910	79.76	69.70	0.067	1.135	0.992
			1970	985	79.63	68.12	0.078	1.133	0.969
			2121	1061	80.07	68.61	0.077	1.139	0.976
			2274	1137	78.95	71.31	0.051	1.123	1.015
			2427	1214	77.43	72.08	0.036	1.102	1.026
			2581	1291	76.54	71.66	0.033	1.089	1.020
			2734	1367	74.18	75.07	-0.006	1.056	1.068
			2884	1442	72.64	76.23	-0.024	1.034	1.085
			3031	1516	72.30	78.17	-0.039	1.029	1.112
			3176	1588	70.90	79.78	-0.059	1.009	1.135
			3319	1660	70.22	81.55	-0.075	0.999	1.160
			3460	1730	70.47	82.18	-0.077	1.003	1.169
			3600	1800	69.47	82.80	-0.088	0.989	1.178
			3734	1867	70.82	84.94	-0.091	1.008	1.209

Table D1 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, $D_o \approx 75$ (±7) μm) (cont.)

Test	Gap (μm)	D_o (μm)	time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a^*/D_o	c/D_o
10	2400	70.3	3863	1932	69.34	84.22	-0.097	0.987	1.198
			3989	1995	69.16	85.65	-0.107	0.984	1.219
			4111	2056	68.06	84.91	-0.110	0.968	1.208
			4230	2115	67.11	85.97	-0.123	0.955	1.223
			4343	2172	67.04	85.54	-0.121	0.954	1.217
			4455	2228	67.33	85.70	-0.120	0.958	1.219
			4565	2283	68.70	86.61	-0.115	0.978	1.232
			4672	2336	68.04	86.22	-0.118	0.968	1.227
			4830	2415	67.02	86.10	-0.125	0.954	1.225
			4983	2492	66.90	85.72	-0.123	0.952	1.220
			5133	2567	66.53	87.45	-0.136	0.947	1.244
			5279	2640	66.67	86.15	-0.127	0.949	1.226
			5379	2690	68.19	87.63	-0.125	0.970	1.247
11	1970	78.9	93	47	85.73	83.81	0.011	1.086	1.062
			185	93	84.41	93.90	-0.053	1.070	1.190
			277	139	84.18	97.90	-0.075	1.067	1.241
			370	185	81.61	103.07	-0.116	1.034	1.306
			463	232	80.67	104.33	-0.128	1.022	1.322
			555	278	80.40	105.50	-0.135	1.019	1.337
			647	324	84.00	104.40	-0.108	1.065	1.323
			738	369	83.74	100.40	-0.090	1.061	1.272
			829	415	86.12	96.50	-0.057	1.091	1.223
			922	461	87.13	94.97	-0.043	1.104	1.204
			1015	508	87.26	90.46	-0.018	1.106	1.146
			1108	554	89.04	91.37	-0.013	1.128	1.158
			1202	601	89.13	86.22	0.017	1.130	1.093

Table D1 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, $D_o \approx 75$ (±7) μm) (cont.)

Test	Gap (μm)	D_o (μm)	time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a^*/D_o	c/D_o
11	1970	78.9	1296	648	90.52	83.68	0.039	1.147	1.061
			1391	696	89.93	82.68	0.042	1.140	1.048
			1486	743	90.49	80.75	0.057	1.147	1.023
			1581	791	91.88	79.92	0.070	1.164	1.013
			1677	839	92.20	78.50	0.080	1.168	0.995
			1773	887	92.00	78.81	0.077	1.166	0.999
			1869	935	90.41	78.02	0.074	1.146	0.989
			1965	983	89.67	78.03	0.069	1.136	0.989
			2061	1031	90.52	78.79	0.069	1.147	0.999
			2157	1079	88.03	79.48	0.051	1.116	1.007
			2253	1127	88.74	80.37	0.049	1.125	1.019
			2348	1174	88.57	80.87	0.045	1.122	1.025
			2444	1222	88.14	82.71	0.032	1.117	1.048
			2540	1270	86.40	84.07	0.014	1.095	1.065
			2636	1318	84.36	84.75	-0.002	1.069	1.074
			2732	1366	84.19	85.19	-0.006	1.067	1.080
			2828	1414	84.01	86.57	-0.015	1.065	1.097
			3019	1510	82.87	87.29	-0.026	1.050	1.106
			3209	1605	81.27	88.46	-0.042	1.030	1.121
			3399	1700	80.38	88.85	-0.050	1.019	1.126
			3588	1794	79.83	90.82	-0.064	1.012	1.151
			3778	1889	79.23	92.56	-0.078	1.004	1.173
			3968	1984	77.66	93.54	-0.093	0.984	1.185
			4158	2079	76.78	95.23	-0.107	0.973	1.207
			4348	2174	76.64	96.49	-0.115	0.971	1.223
			4631	2316	75.97	95.84	-0.116	0.963	1.215

Table D1 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, $D_o \approx 75$ (±7) μm) (cont.)

Test	Gap (μm)	D_o (μm)	time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a^*/D_o	c/D_o
11	1970	78.9	4820	2410	75.48	96.41	-0.122	0.957	1.222
			5009	2505	76.20	96.64	-0.118	0.966	1.225
			5198	2599	75.50	96.97	-0.124	0.957	1.229
			5386	2693	75.44	96.63	-0.123	0.956	1.225
			5667	2834	75.53	95.24	-0.115	0.957	1.207
			5854	2927	75.44	95.71	-0.118	0.956	1.213
			6041	3021	75.21	96.41	-0.124	0.953	1.222
			6413	3207	74.63	96.05	-0.125	0.946	1.217
			6596	3298	75.85	94.85	-0.111	0.961	1.202

Table D2 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, D_o = 52, 110, and 122 μm)

D_o (μm)	Gap (μm)	Time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a^*/D_o	c/D_o
52.3	2180	85	43	57.0	53.8	0.029	1.091	1.029
		170	85	54.5	56.5	-0.018	1.042	1.081
		255	128	54.8	58.2	-0.031	1.049	1.115
		421	211	53.7	59.9	-0.054	1.028	1.146
		504	252	54.0	58.0	-0.035	1.034	1.110
		585	293	53.5	58.7	-0.046	1.025	1.123
		664	332	54.7	57.2	-0.022	1.048	1.095
		752	376	57.5	57.5	0.000	1.101	1.101
		900	450	56.7	54.8	0.018	1.086	1.048
		978	489	57.3	53.9	0.031	1.096	1.031
		1134	567	57.6	52.2	0.050	1.103	0.998
		1290	645	57.8	50.9	0.063	1.106	0.974
		1445	723	58.5	50.0	0.078	1.119	0.957
		1599	800	59.7	51.6	0.073	1.142	0.988
		1752	876	60.0	51.5	0.077	1.149	0.985
		1906	953	59.4	51.0	0.076	1.136	0.976
		2058	1029	59.3	51.0	0.075	1.135	0.976
		2210	1105	59.2	51.0	0.075	1.134	0.975
		2286	1143	58.9	51.7	0.065	1.127	0.990
		2439	1220	58.4	52.6	0.052	1.118	1.008
		2592	1296	58.2	53.6	0.041	1.113	1.026
		2819	1410	56.0	54.7	0.012	1.072	1.047
		2970	1485	56.0	55.3	0.006	1.072	1.058

Table D2 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, D_o = 52, 110, and 122 μm) (cont.)

D_o (μm)	Gap (μm)	Time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a^*/D_o	c/D_o
52.3	2180	3121	1561	54.8	57.0	-0.020	1.050	1.092
		3271	1636	55.3	57.2	-0.017	1.058	1.095
		3420	1710	54.4	57.8	-0.030	1.042	1.106
		3569	1785	54.2	58.6	-0.039	1.037	1.121
		3714	1857	54.1	58.5	-0.039	1.036	1.120
		3859	1930	54.5	58.3	-0.034	1.043	1.116
		4001	2001	53.4	58.9	-0.049	1.022	1.126
		4141	2071	53.1	59.0	-0.052	1.017	1.129
		4280	2140	52.7	59.2	-0.058	1.009	1.134
		4414	2207	53.5	59.2	-0.051	1.023	1.133
		4547	2274	53.3	59.3	-0.053	1.020	1.136
		4678	2339	53.4	59.3	-0.052	1.023	1.135
		4806	2403	52.7	59.1	-0.057	1.009	1.131
		4870	2435	53.5	59.4	-0.052	1.024	1.136
		4993	2497	53.1	59.7	-0.059	1.016	1.143
110	2250	80	40	132.1	120.6	0.046	1.202	1.097
		160	80	128.4	136.1	-0.029	1.168	1.238
		245	123	132.8	147.6	-0.053	1.207	1.342
		329	165	128.7	154.2	-0.090	1.171	1.402
		499	250	127.0	161.4	-0.119	1.155	1.468
		666	333	134.0	150.0	-0.056	1.219	1.364
		828	414	134.0	144.0	-0.036	1.219	1.310
		989	495	137.0	133.0	0.015	1.246	1.210
		1069	535	139.0	132.0	0.026	1.264	1.201
		1149	575	144.7	122.0	0.085	1.316	1.110
		1472	736	145.9	113.1	0.127	1.327	1.028

Table D2 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, D_o = 52, 110, and 122 μm) (cont.)

D_o (μm)	Gap (μm)	Time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a*/D_o	c/D_o
110	2250	1637	819	146.4	112.8	0.130	1.331	1.026
		1802	901	143.7	113.1	0.119	1.307	1.029
		1964	982	139.3	114.5	0.098	1.267	1.041
		2129	1065	139.2	114.9	0.095	1.266	1.045
		2295	1148	135.0	120.0	0.059	1.228	1.091
		2460	1230	130.0	120.1	0.039	1.182	1.092
		2792	1396	122.7	129.2	-0.026	1.116	1.175
		2959	1480	119.8	126.1	-0.026	1.089	1.147
		3126	1563	120.1	130.3	-0.041	1.092	1.185
		3460	1730	114.6	135.2	-0.083	1.042	1.230
		3790	1895	110.5	139.5	-0.116	1.005	1.269
		3954	1977	111.1	139.2	-0.112	1.010	1.266
		4115	2058	109.2	140.9	-0.127	0.993	1.281
		4436	2218	108.7	142.4	-0.134	0.989	1.295
		4594	2297	106.7	142.6	-0.144	0.970	1.297
		4754	2377	105.4	144.6	-0.157	0.959	1.315
		5067	2534	105.1	147.9	-0.169	0.956	1.346
		5144	2572	104.0	148.6	-0.177	0.946	1.352
		5452	2726	103.3	150.7	-0.187	0.940	1.371
		5755	2878	102.6	151.8	-0.193	0.933	1.381
		6203	3102	101.0	154.8	-0.210	0.918	1.408
		6423	3212	100.4	155.7	-0.216	0.913	1.416
		6513	3257	99.6	157.7	-0.226	0.906	1.434
		6538	3269	97.9	158.5	-0.236	0.890	1.441
		6686	3343	97.7	162.7	-0.250	0.888	1.480
		6827	3414	96.2	165.3	-0.264	0.875	1.503

Table D2 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, D_o = 52, 110, and 122 μm) (cont.)

D_o (μm)	Gap (μm)	Time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a*/D_o	c/D_o
110	2250	6960	3480	94.1	170.5	-0.289	0.855	1.550
		7083	3542	91.8	175.0	-0.312	0.835	1.592
122	2200	100	50	147.6	133.0	0.052	1.210	1.090
		192	96	144.3	153.3	-0.030	1.183	1.256
		282	141	143.4	161.0	-0.058	1.175	1.320
		371	186	138.9	170.8	-0.103	1.138	1.400
		463	232	140.4	181.7	-0.128	1.151	1.489
		553	277	137.4	192.7	-0.167	1.126	1.579
		806	403	160.0	163.0	-0.009	1.311	1.336
		972	486	164.0	148.5	0.050	1.344	1.217
		1135	568	162.9	136.7	0.088	1.335	1.120
		1300	650	166.4	128.9	0.127	1.364	1.056
		1635	818	163.2	122.4	0.143	1.338	1.004
		1803	902	167.6	124.3	0.148	1.374	1.019
		1970	985	160.6	124.9	0.125	1.316	1.024
		2137	1069	157.5	121.5	0.129	1.291	0.996
		2304	1152	155.8	116.5	0.144	1.277	0.955
		2469	1235	150.2	126.9	0.084	1.231	1.040
		2635	1318	145.5	132.8	0.046	1.193	1.088
		2801	1401	135.9	142.8	-0.025	1.114	1.171
		2967	1484	136.3	143.2	-0.024	1.117	1.173
		3138	1569	133.4	147.8	-0.051	1.093	1.211
		3461	1731	124.6	157.4	-0.116	1.022	1.290
		3699	1850	120.6	165.4	-0.157	0.988	1.355
		4008	2004	119.3	171.2	-0.179	0.978	1.403
		4232	2116	115.9	174.0	-0.201	0.950	1.427

Table D2 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.5\ s^{-1}$, D_o = 52, 110, and 122 μm) (cont.)

D_o (μm)	Gap (μm)	Time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a*/D_o	c/D_o
122	2200	4522	2261	114.4	178.9	-0.220	0.938	1.466
		4801	2401	112.1	182.7	-0.240	0.919	1.497
		5204	2602	109.9	187.3	-0.261	0.900	1.535
		5529	2765	108.4	191.2	-0.276	0.889	1.567
		5847	2924	106.2	197.6	-0.301	0.870	1.619
		6097	3049	104.7	203.9	-0.321	0.858	1.671
		6525	3263	99.2	216.1	-0.371	0.813	1.771
		6999	3500	94.7	241.4	-0.437	0.776	1.979
		7174	3587	91.7	254.5	-0.470	0.752	2.086
		7348	3674	87.8	275.9	-0.517	0.719	2.262
		7461	3731	85.9	292.4	-0.546	0.704	2.397

Table D3 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.28\ s^{-1}$, $D_o \approx$ 135 μm)

D_o (μm)	Gap (μm)	Time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a*/D_o	c/D_o
134.6	2250	145	41	161.8	147.2	0.047	1.202	1.093
		435	122	153.6	175.8	-0.067	1.141	1.306
		581	163	152.3	185.5	-0.098	1.131	1.378
		727	204	151.5	191.0	-0.115	1.125	1.418
		873	244	152.1	189.6	-0.110	1.130	1.408
		1018	285	153.4	191.3	-0.110	1.139	1.421
		1163	326	154.9	187.3	-0.095	1.150	1.391
		1308	366	159.2	178.8	-0.058	1.182	1.328
		1454	407	167.0	172.0	-0.015	1.240	1.278
		1597	447	168.0	165.0	0.009	1.248	1.226
		1742	488	172.0	154.0	0.055	1.278	1.144
		1889	529	180.0	148.0	0.098	1.337	1.099
		2180	610	183.1	141.2	0.129	1.360	1.049
		2326	651	175.5	136.9	0.124	1.303	1.017
		2472	692	178.8	134.6	0.141	1.328	1.000
		2619	733	184.6	132.2	0.165	1.371	0.982
		2768	775	185.1	132.9	0.164	1.375	0.987
		2916	816	182.8	132.6	0.159	1.358	0.985
		3063	858	181.1	131.9	0.157	1.345	0.979
		3210	899	180.1	129.2	0.165	1.338	0.960
		3355	939	177.8	128.4	0.162	1.321	0.953
		3500	980	185.3	129.0	0.179	1.376	0.958
		3644	1020	173.4	128.9	0.147	1.288	0.957
		3787	1060	175.9	132.2	0.142	1.307	0.982
		3929	1100	176.0	133.0	0.139	1.307	0.988
		4070	1140	179.0	132.0	0.151	1.329	0.980

Table D3 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.28\ s^{-1}$, $D_o \approx$ 135 μm) (cont.)

D_o (μm)	Gap (μm)	Time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a*/D_o	c/D_o
134.6	2250	4209	1179	177.6	133.2	0.143	1.319	0.989
		4486	1256	172.5	131.7	0.134	1.281	0.978
		4758	1332	168.6	132.8	0.119	1.252	0.986
		5027	1408	166.4	136.7	0.098	1.236	1.015
		5291	1481	161.4	139.2	0.074	1.199	1.034
		5551	1554	158.2	140.3	0.060	1.175	1.042
		5808	1626	156.8	141.7	0.050	1.165	1.053
		6064	1698	153.1	144.4	0.029	1.137	1.073
		6318	1769	149.0	143.2	0.020	1.107	1.064
		6570	1840	151.0	148.0	0.010	1.122	1.099
		6822	1910	148.0	148.4	-0.001	1.099	1.102
		7072	1980	146.2	152.3	-0.021	1.086	1.131
		7322	2050	142.7	154.9	-0.041	1.060	1.150
		7570	2120	141.6	158.7	-0.057	1.052	1.179
		7817	2189	140.4	160.7	-0.067	1.043	1.193
		8306	2326	138.1	163.4	-0.084	1.026	1.214
		8546	2393	137.4	164.4	-0.090	1.021	1.221
		8783	2459	135.9	164.5	-0.095	1.009	1.222
		9014	2524	136.7	165.2	-0.094	1.015	1.227
		9352	2619	134.0	168.0	-0.112	0.995	1.247
		9681	2711	133.5	168.2	-0.115	0.991	1.250
		10002	2801	132.0	170.4	-0.127	0.981	1.265
		10212	2859	131.4	171.6	-0.133	0.976	1.275
		10418	2917	131.9	171.2	-0.130	0.980	1.271

Table D3 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.28\ s^{-1}$, $D_o \approx$ 135 μm) (cont.)

D_o (μm)	Gap (μm)	Time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a^*/D_o	c/D_o
134.9	2100	156	44	167.8	144.5	0.075	1.243	1.070
		311	88	166.2	160.6	0.017	1.231	1.190
		463	131	167.2	171.1	-0.011	1.239	1.268
		616	174	168.4	175.0	-0.019	1.248	1.296
		768	217	171.2	175.4	-0.012	1.268	1.299
		1059	299	167.2	173.1	-0.017	1.239	1.282
		1204	340	170.6	170.0	0.002	1.264	1.259
		1350	382	176.2	163.2	0.038	1.305	1.209
		1496	423	179.2	159.4	0.059	1.328	1.181
		1640	464	181.8	156.9	0.073	1.347	1.162
		1783	504	185.5	153.4	0.095	1.374	1.136
		1926	545	181.8	148.7	0.100	1.347	1.102
		2066	584	183.6	146.5	0.112	1.360	1.086
		2203	623	192.0	143.0	0.146	1.422	1.060
		2341	662	188.3	135.9	0.162	1.395	1.007
		2477	700	183.6	131.0	0.167	1.360	0.970
		2615	740	183.7	130.5	0.169	1.360	0.967
		2755	779	185.0	133.6	0.161	1.370	0.989
		2897	819	189.2	134.0	0.171	1.402	0.993
		3039	859	184.8	132.7	0.164	1.369	0.983
		3181	900	185.5	133.0	0.165	1.374	0.985
		3325	940	187.3	133.6	0.167	1.388	0.990
		4040	1143	176.3	128.4	0.157	1.306	0.951
		4324	1223	174.5	130.7	0.144	1.293	0.968
		4609	1303	170.7	131.8	0.129	1.264	0.976
		4893	1384	170.7	130.0	0.135	1.264	0.963

Table D3 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.28\ s^{-1}$, $D_o \approx$ 135 μm) (cont.)

D_o (μm)	Gap (μm)	Time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a^*/D_o	c/D_o
134.9	2100	5177	1464	166.4	133.1	0.111	1.233	0.986
		5460	1544	164.3	137.1	0.090	1.217	1.015
		5888	1665	157.9	138.8	0.065	1.170	1.028
		6173	1746	153.3	145.0	0.028	1.135	1.074
		6601	1867	150.1	146.7	0.011	1.112	1.087
		7034	1989	147.3	150.7	-0.011	1.091	1.116
		7466	2111	142.8	156.3	-0.045	1.058	1.157
		7898	2234	138.7	161.0	-0.074	1.027	1.193
		8187	2315	139.5	161.8	-0.074	1.033	1.199
		8617	2437	137.7	162.8	-0.083	1.020	1.206
		9045	2558	135.7	167.7	-0.106	1.005	1.242
		9470	2678	132.8	169.5	-0.121	0.984	1.255
		9609	2717	133.0	170.2	-0.123	0.985	1.261
		10029	2836	131.8	172.0	-0.132	0.976	1.274
		10440	2952	131.9	172.1	-0.132	0.977	1.275
		10711	3029	131.0	171.2	-0.133	0.970	1.268
		10979	3105	131.3	172.4	-0.135	0.973	1.277
		11240	3179	130.8	172.1	-0.136	0.969	1.275
		11499	3252	130.5	173.8	-0.142	0.967	1.287
		11627	3288	131.5	173.0	-0.136	0.974	1.282

Table D4 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.8\ s^{-1}$, $D_o \approx 46\ \mu m$)

D_o (μm)	Gap (μm)	time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a*/D_o	c/D_o
46.5	2100	58	46	51.3	46.5	0.049	1.103	1.000
		108	86	48.2	49.4	-0.012	1.036	1.062
		163	130	47.1	51.5	-0.045	1.012	1.108
		215	172	47.3	52.2	-0.049	1.018	1.124
		269	215	46.5	53.6	-0.071	1.001	1.153
		323	258	46.6	54.6	-0.079	1.003	1.174
		580	464	46.6	53.3	-0.067	1.003	1.147
		634	507	47.1	52.2	-0.051	1.014	1.122
		742	594	47.5	49.8	-0.024	1.021	1.071
		851	681	49.2	48.4	0.008	1.058	1.041
		960	768	49.2	46.3	0.030	1.058	0.995
		1070	856	49.3	46.3	0.031	1.060	0.995
		1181	945	48.9	46.7	0.023	1.052	1.005
		1291	1033	47.8	47.4	0.004	1.028	1.020
		1402	1122	47.6	48.4	-0.009	1.024	1.042
		1512	1210	46.8	48.9	-0.023	1.006	1.052
		1622	1298	47.5	51.2	-0.037	1.022	1.101
		1734	1387	46.5	52.2	-0.058	1.000	1.124
44.6	2100	1846	1477	45.0	50.6	-0.059	1.008	1.134
		1947	1558	44.5	51.7	-0.075	0.998	1.159
		2103	1682	44.9	51.9	-0.072	1.007	1.163
		2103	1682	44.0	51.3	-0.076	0.987	1.149
		2206	1765	44.7	52.4	-0.079	1.002	1.174
46.5	2100	2309	1847	46.1	54.1	-0.080	0.991	1.164
42.5	2100	2412	1930	42.3	50.6	-0.089	0.996	1.191
		2557	2046	43.3	53.3	-0.103	1.020	1.254

Table D4 Raw data of transient experiment (System A at 147°C; $\dot{\gamma} = 0.8\ s^{-1}$, $D_o \approx$ 46 μm) (cont.)

D_o (μm)	Gap (μm)	time (s)	Strain (%)	a* (μm)	c (μm)	Def*	a*/D_o	c/D_o
47.5	2100	2600	2080	46.7	59.2	-0.118	0.983	1.247
		2814	2251	47.5	60.0	-0.117	0.999	1.263
		2867	2294	47.3	60.2	-0.120	0.995	1.267
		2910	2328	46.5	60.0	-0.126	0.979	1.262
		3084	2467	46.6	60.1	-0.126	0.981	1.265
		3202	2562	46.9	59.9	-0.121	0.988	1.260
		3300	2640	46.1	59.4	-0.126	0.970	1.251

APPENDIX E

Raw Data in Steady State Experiments

Table E1 Raw data of steady state experiment; system A at 147°C

Test	Time (min)	Gap (μm)	Shear rate (s^{-1})	D_o (μm)	Ca	a* (μm)	c (μm)	Def*
1	140	2300	0.3	110.5	7.2	110.0	136.0	-0.106
2	143	2380	0.3	104.0	6.8	105.2	123.9	-0.081
3	150	2400	0.3	82.1	5.4	83.4	92.6	-0.052
4	140	2450	0.3	75.4	5.0	78.0	82.6	-0.029
5	150	2450	0.3	138.7	9.0	132.1	197.9	-0.199
6	137	2400	0.3	41.3	2.7	42.5	42.9	-0.005
7	150	2450	0.3	80.7	5.3	80.5	91.9	-0.066
8	83	2480	0.6	66.0	7.8	63.0	86.7	-0.158
9	88	2400	0.5	70.3	7.1	66.7	86.2	-0.127
10	100	2200	0.5	63.9	6.5	62.1	76.4	-0.103
11	90	2130	0.5	83.8	8.5	76.8	119.6	-0.218
12	88	2080	0.5	58.3	6.0	57	63.7	-0.060
13	125	2100	0.5	90.7	9.1	84.1	128.3	-0.208
14	125	2100	0.5	84.1	8.6	81.2	111.5	-0.157
15	100	2250	0.5	46.2	4.7	46.5	51.5	-0.051
16	110	2050	0.5	67.9	6.9	68.3	84.2	-0.104
17	117	1970	0.5	78.9	8.0	75.5	96.4	-0.125
18	110	2050	0.5	29.0	2.9	29.5	29.8	-0.005
19	105	2150	0.5	82.8	8.4	79.6	110.7	-0.164
20	95	2050	0.5	78.7	8.0	74.8	98.7	-0.138
21	100	2200	0.5	68.3	6.9	66.5	84.1	-0.117

Table E2 Raw data of steady state experiment; system B at 139°C

Test	Time (min)	Gap (μm)	Shear rate (s^{-1})	D_o (μm)	Ca	a* (μm)	c (μm)	Def*
1	25	1900	1	93.0	4.74	98.1	100.0	-0.010
2	40	1900	1	66.1	3.36	68.0	66.9	0.008
3	30	2100	1	137.5	7.00	153.0	163.3	-0.033
4	40	1950	1	131.9	6.72	136.9	145.5	-0.031
5	64	1950	1	144.6	7.36	155.2	169.0	-0.042
6	37	1950	1	123.5	6.29	128.7	133.8	-0.020
7	37	1900	1	119.3	6.08	126.8	134.1	-0.028
8	137	1900	1	186.5	9.50	189.4	223.1	-0.082
9	135	1900	1	133.2	6.79	135.7	146.4	-0.038
10	70	2050	1	168.5	8.58	173.7	204.0	-0.080
11	45	2200	1	174.2	8.87	181.2	210.6	-0.075
12	70	2200	1	222.5	11.33	241.9	299.9	-0.107
13	60	2200	1	220.9	11.25	227.5	278.8	-0.101
14	60	2000	1	251.0	13.55	262.0	359.0	-0.156

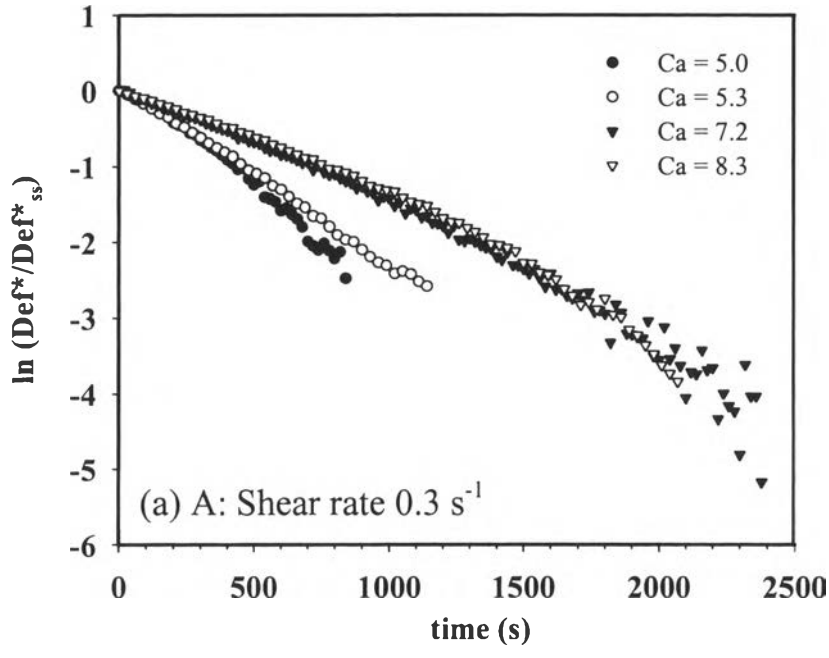
APPENDIX F

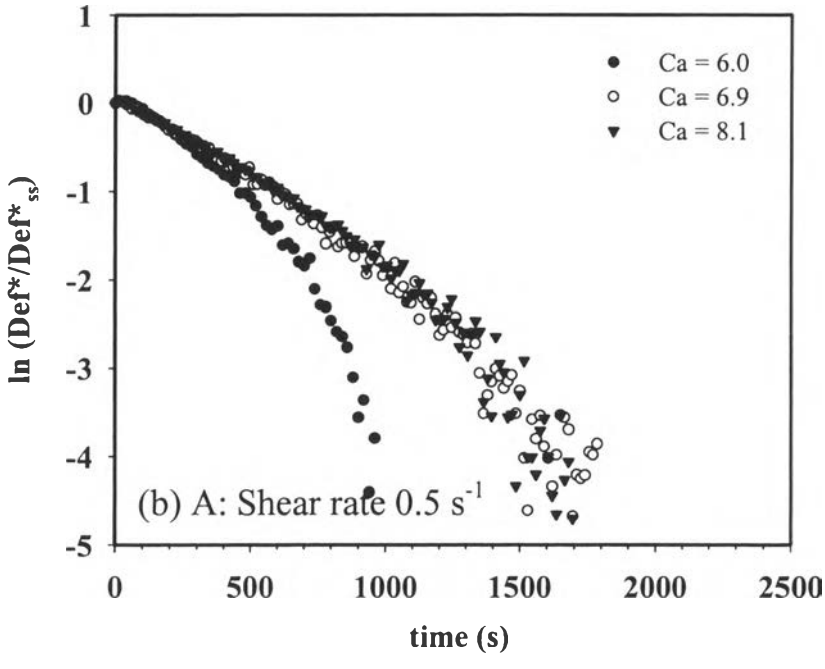
Relaxation after Cessation of Steady Shear

Figure F1 (a), (b), and (c) shows the relaxation of Def* normalized by its steady-state value Def^*_{ss}. after cessation of steady shearing at the shear rates shown, for different droplet sizes (and hence different capillary numbers). The logarithm of Def^*/Def^*_{ss} first decreases linearly with time, gradually changing to a nonlinear relaxation at long times. The shear rates are 0.3, 0.5 s^{-1} for system A, and 1 s^{-1} for system B in Fig.F1 (a), (b), and (c), respectively. Since the initial decay of ln $[Def^*/Def^*_{ss}]$ is linear, we can write

$$\frac{Def^*}{Def^*_{ss}} = e^{-t/\tau} \tag{3}$$

where τ is the droplet relaxation time after cessation of steady shear. Figure F2 plots τ vs. Ca at the two shear rates for system A and the one shear rate for system B. The relaxation time increases roughly linearly with Ca., consistent with the behavior for Newtonian systems in which the relaxation time is proportional to droplet radius, and therefore to Ca, when the shear rate is fixed. The three sets of data, at shear rates of 0.3 and 0.5 s^{-1} for system A, and shear rate of 1 s^{-1} for system B, however do not collapse, however, showing that that τ is not a unique function of Ca and there should be other factors involved. We also note that τ of system A at the shear rate of 0.3 s^{-1} is greater than that of shear rate 0.5 s^{-1} and τ of system B at shear rate of 1 s^{-1}, respectively. From Fig. 3.2 (Chapter 3), it can be noted that the elasticity ratio (G'_r) of system A at the shear rate of 0.3 s^{-1} is slightly lower than that at the shear rate of 0.5 s^{-1}, and 3-4 times lower than G'_r of system B at the shear rate of 1 s^{-1}. At a fixed Ca, the droplet subject to a larger shear relaxes faster.


Ca = 5.0
Ca = 5.3
Ca = 7.2
Ca = 8.3
(a) A: Shear rate 0.3 s-1
ln (Def*/Def*ss)
time (s)
1
0
-1
-2
-3
-4
-5
-6
0
500
1000
1500
2000
2500


Ca = 6.0
Ca = 6.9
Ca = 8.1
(b) A: Shear rate 0.5 s-1
ln (Def*/Def*ss)
time (s)
1
0
-1
-2
-3
-4
-5
0
500
1000
1500
2000
2500

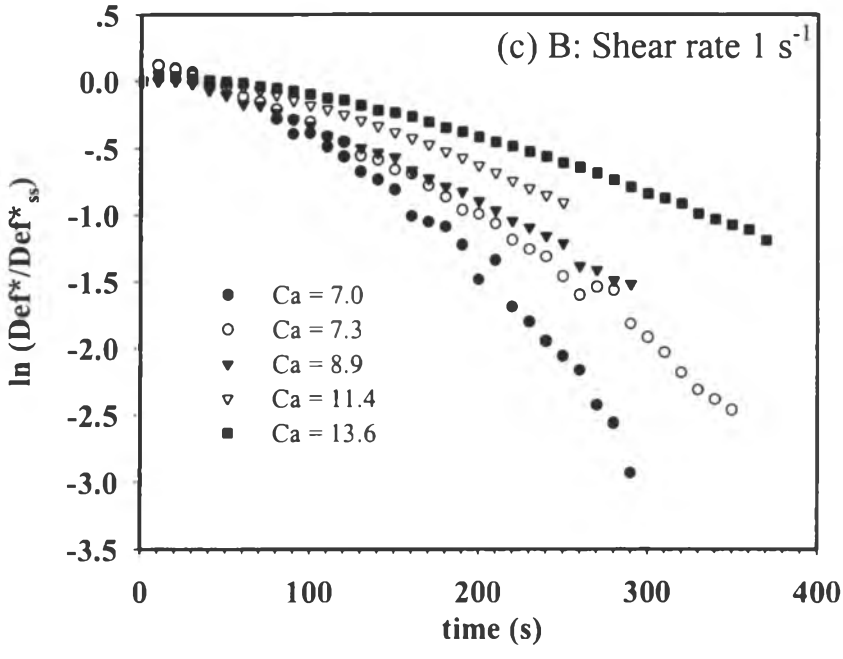


Figure F1 Recovery of Def* normalized by its steady-state value Def^*_{ss} after cessation of steady-state shear: for system A:,(a) Shear rate 0.3 s^{-1}, (b) Shear rate 0.5 s^{-1}; and for system B, (c) Shear rate 1 s^{-1}.

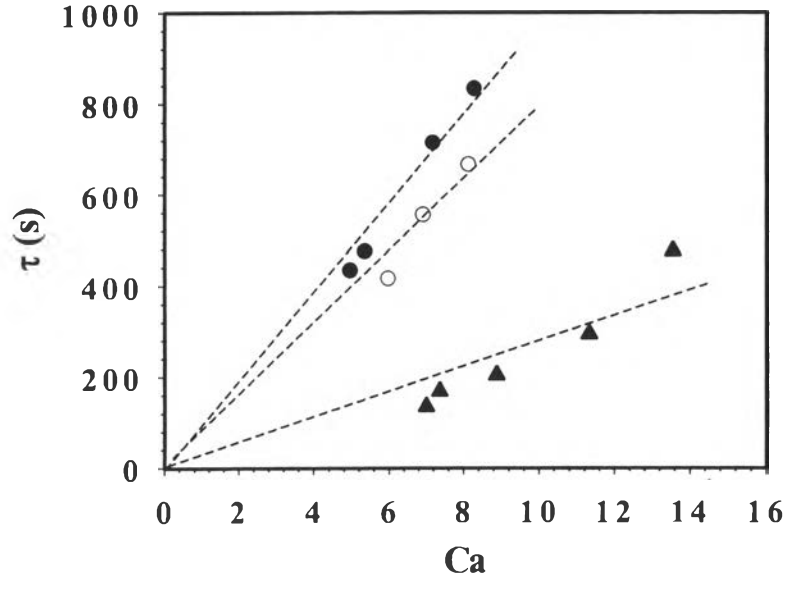


Figure F2 Dependence of the characteristic relaxation time on shear rate: for system A, shear rate 0.3 s^{-1} (●), shear rate 0.5 s^{-1} (o); and for system B, shear rate 1 s^{-1} (▲).

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