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APPENDICES

APPENDIX A

CRITICAL CONDITIONS

Table A(1) Critical frequency at different strain amplitudes at the temperatures of 160, 180, and 200°C for H5690S (Data for Figure 3.12(a)).

Strain (%)	160°C			180°C			200°C		
	ω_d*		SD	ω_d*		SD	ω_d*		SD
15	41.0	-	-	43.0	-	-	-	-	-
20	-	-	-	-	-	-	45.0	-	-
30	8.0	-	-	8.6	8.7	0.07	20.0	-	-
50	5.0	-	-	3.5	-	-	11.0	-	-
70	2.0	-	-	2.1	2.2	0.07	5.0	-	-
150	0.6	-	-	0.7	-	-	2.0	-	-
300	0.3	0.3	0.0	0.4	-	-	0.5	0.6	0.07

Table A(2) Critical stress at different strain amplitudes at the temperatures of 160, 180, and 200°C for H5690S.

Strain (%)	160°C			180°C			200°C		
	σ_d* ($\times 10^{-5}$)		SD	σ_d* ($\times 10^{-5}$)		SD	σ_{d1}* ($\times 10^{-5}$)		SD
15	2.40	-	-	1.90	-	-	-	-	-
20	-	-	-	-	-	-	3.50	-	-
30	2.16	-	-	1.62	1.65	0.02	3.00	-	-
50	1.80	-	-	1.38	-	-	2.70	-	-
70	1.49	-	-	1.26	1.21	0.04	2.00	-	-
150	1.42	-	-	1.19	-	-	1.80	-	-
300	1.38	1.35	0.02	1.15	-	-	1.67	1.62	0.04

Table A(3) $\omega_d \cdot \eta_o(T)/T$ for H5690S at 160°C (Data for Figure 3.13).

γ (%)	σ (×10⁻⁵)	$\eta_o(T)$ ($\times 10^{-5}$)	ω_d*		$\omega_d \cdot \eta_o(T)/T$ ($\times 10^{-3}$)		Mean $\omega_d \cdot \eta_o(T)/T$ ($\times 10^{-3}$)	SD
15	2.40	2.0	41.0	-	18.94	-	18.94	-
20	-	-	-	-	-	-	-	-
30	2.16	2.0	8.0	-	3.70	-	3.70	-
50	1.80	2.0	5.0	-	2.31	-	2.31	-
70	1.49	2.0	2.0	-	0.92	-	0.92	-
150	1.42	2.0	0.6	-	0.28	-	0.28	-
300	1.38	2.0	0.3	0.3	0.14	0.14	0.14	0.00

Table A(4) $\omega_d \cdot \eta_o(T)/T$ for H5690S at 180°C (Data for Figure 3.13).

γ (%)	σ ($\times 10^{-5}$)	$\eta_o(T)$ ($\times 10^{-5}$)	ω_d*		$\omega_d \cdot \eta_o(T)/T$ ($\times 10^{-3}$)		Mean $\omega_d \cdot \eta_o(T)/T$ ($\times 10^{-3}$)	SD
15	1.90	5.7	43.0	-	5.30	-	5.30	-
20	-	-	-	-	-	-	-	-
30	1.64	5.7	8.6	8.7	1.08	1.09	1.085	0.007
50	1.38	5.7	3.5	-	0.43	-	0.430	-
70	1.24	5.7	2.1	2.2	0.26	0.27	0.265	0.007
150	1.19	5.7	0.7	-	0.09	-	0.09	-
300	1.15	5.7	0.4	-	0.05	-	0.05	-

Table A(5) $\omega_d{\cdot}\eta_o(T)/T$ for H5690S at 200°C (Data for Figure 3.13).

γ (%)	σ (×10^{-5})	η_o(T) (×10^{-5})	ω_d*		$\omega_d{\cdot}\eta_o$(T)/T (×10^{-3})		Mean $\omega_d{\cdot}\eta_o$(T)/T (×10^{-3})	SD
15	-	-	-	-	-	-	-	-
20	3.50	4.0	45.0	-	3.80	-	3.800	-
30	3.00	4.0	20.0	-	1.69	-	1.690	-
50	2.70	4.0	11.0	-	0.93	-	0.930	-
70	2.00	4.0	5.0	-	0.42	-	0.420	-
150	1.80	4.0	2.0	-	0.17	-	0.170	-
300	1.64	4.0	0.5	0.6	0.04	0.05	0.045	0.007

Table A(6) $\omega_d{\cdot}\eta_o(T)M$ and $\omega_d{\cdot}\eta_o(T)M^3$ for H5690S at 180°C (Data for Figures 3.14 and 3.15) .

Mean ω_d*	η_o(T) (×10^{-5})	M (×10^{-4})	M^3 (×10^{-14})	ω_d*η_o(T)M (×10^{-14})	ω_d*η_o(T)M (×10^{-20})
43.0	5.7	7.4	4.05	18.10	99.30
8.6	5.7	7.4	4.05	3.63	20.00
3.5	5.7	7.4	4.05	1.48	8.08
2.0	5.7	7.4	4.05	0.84	4.62
0.7	5.7	7.4	4.05	0.30	1.62
0.4	5.7	7.4	4.05	0.17	0.92

APPENDIX B

ASYMPTOTIC TRANSIENT ANGULAR SLIP

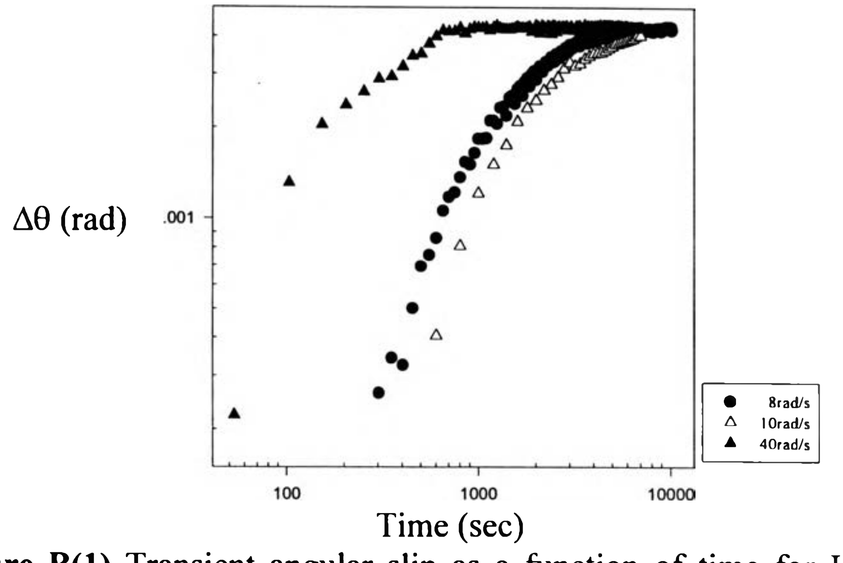

Figure B(1) Transient angular slip as a function of time for H5690S sheared at amplitudes of 30% strains at 160°C.

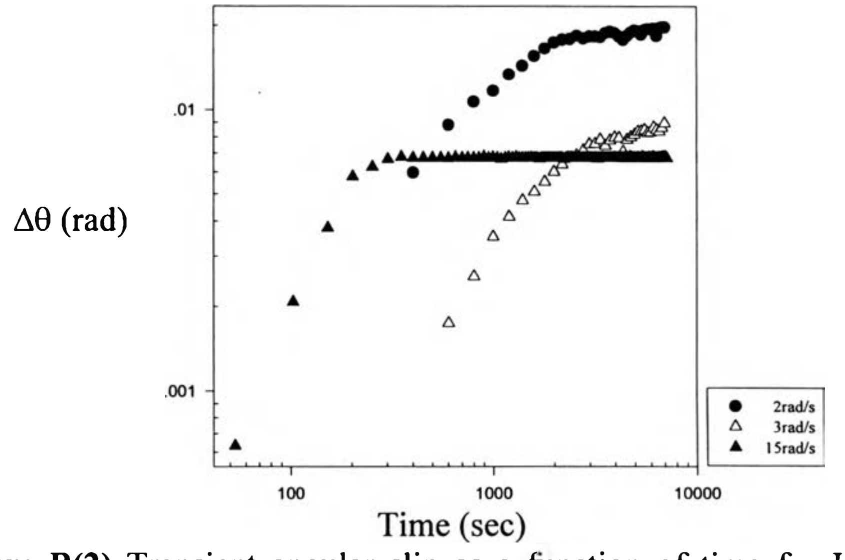

Figure B(2) Transient angular slip as a function of time for H5690S sheared at amplitudes of 70% strains at 160°C.

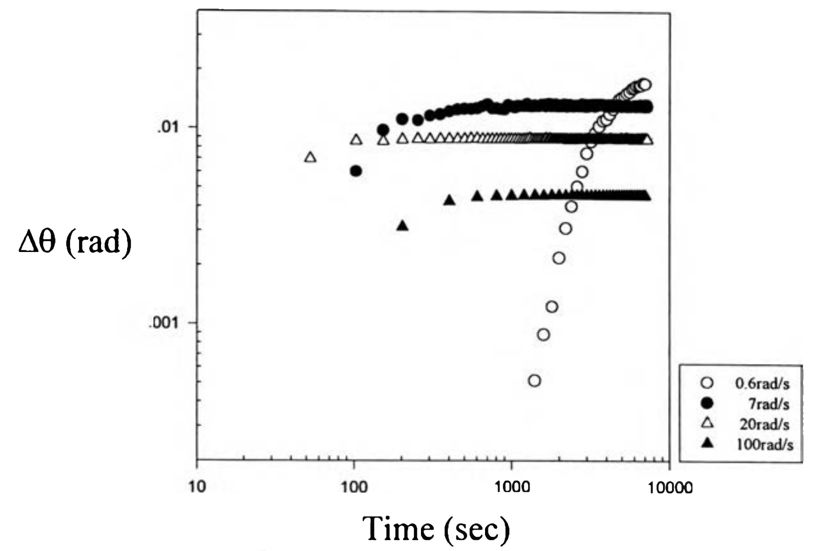

Figure B(3) Transient angular slip as a function of time for H5690S sheared at amplitudes of 150% strains at 160°C.

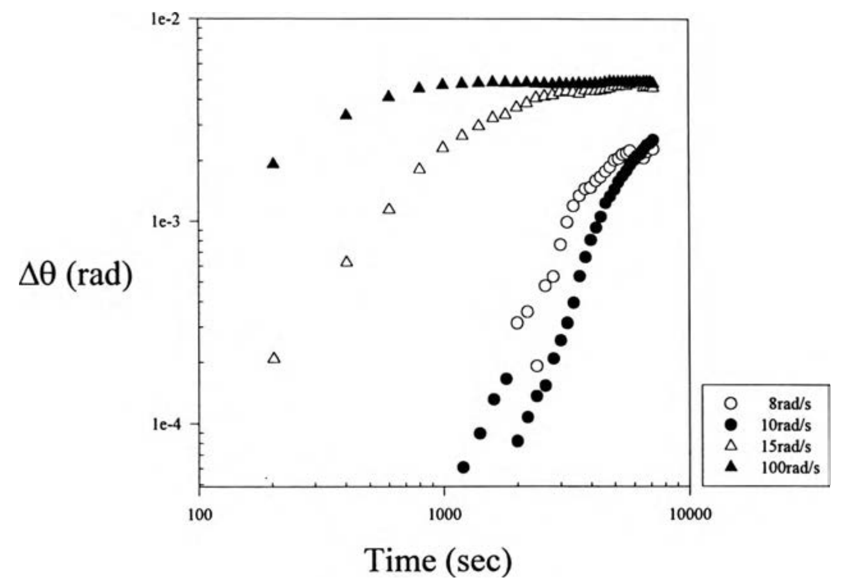

Figure B(4) Transient angular slip as a function of time for H5690S sheared at amplitudes of 30% strains at 180°C.

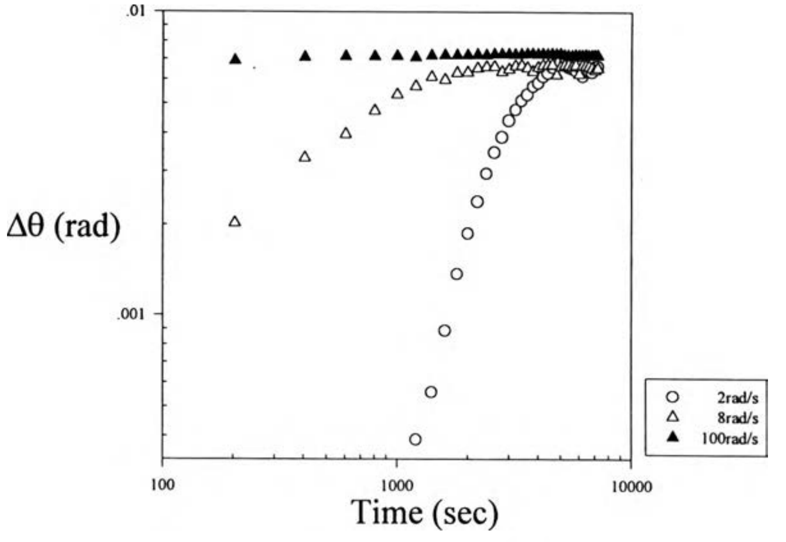

Figure B(5) Transient angular slip as a function of time for H5690S sheared at amplitudes of 70% strains at 180°C.

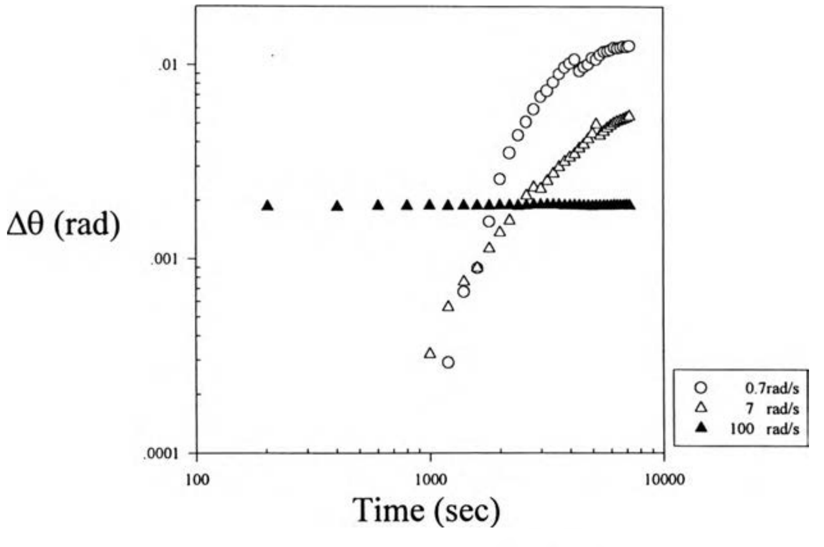

Figure B(6) Transient angular slip as a function of time for H5690S sheared at amplitudes of 150% strains at 180°C.

Table B(1) Asymptotic transient angular slip as a function of strain rate for H5690S sheared at amplitudes of 30, 70, and 150% strains at 160°C (Data for Figure 3.18 (a)).

Strain Rate (rad/s)	$\Delta\theta_{asymptotic}$ (30%Strain)	Strain Rate (rad/s)	$\Delta\theta_{asymptotic}$ (70%Strain)	Strain Rate (rad/s)	$\Delta\theta_{asymptotic}$ (150%Strain)
2.4	4.0×10^{-3}	1.4	2.1×10^{-2}	0.9	4.0×10^{-2}
3.0	4.1×10^{-3}	2.1	1.5×10^{-2}	10.5	1.3×10^{-2}
6.0	4.0×10^{-3}	3.5	1.0×10^{-2}	30.0	0.8×10^{-2}
12.0	3.9×10^{-3}	10.5	0.6×10^{-2}	150.0	0.4×10^{-2}
30.0	4.2×10^{-3}	70.0	0.2×10^{-2}	-	-

Table B(2) Asymptotic transient angular slip as a function of strain rate for H5690S sheared at amplitudes of 30, 70, and 150% strains at 180°C (Data for Figure 3.18 (b)).

Strain Rate (rad/s)	$\Delta\theta_{asymptotic}$ (30%Strain)	Strain Rate (rad/s)	$\Delta\theta_{asymptotic}$ (70%Strain)	Strain Rate (rad/s)	$\Delta\theta_{asymptotic}$ (150%Strain)
2.6	4.3×10^{-3}	1.4	7.0×10^{-3}	1.0	1.3×10^{-2}
3.0	4.4×10^{-3}	5.6	7.0×10^{-3}	10.5	0.7×10^{-2}
4.5	4.4×10^{-3}	70.0	7.2×10^{-3}	150.0	0.2×10^{-2}
30.0	4.4×10^{-3}	-	-	-	-

Table B(3) *$\Delta G^*M/T$* and *$G^*_{asymptotic}M/T$* for H5690S at 160°C (Data for Figure 3.19 and 3.20).

$\dot{\gamma}$	$\dot{\gamma}$ M^2/T (x10^{-7})	ΔG* (x10^{-5})	ΔG*M/T (x10^{-7})	$G^*_{asymptotic}$ (x10^{-5})	$G^*_{asymptotic}M/T$ (x10^{-7})
2.40	3.04	4.00	6.84	1.50	2.56
1.50	1.90	2.00	3.42	1.00	1.71
0.60	0.76	1.00	1.71	0.70	1.20
0.18	0.23	0.50	0.86	0.30	0.51
0.09	0.11	0.20	0.34	0.20	0.34

Table B(4) *$\Delta G^*M/T$* and *$G^*_{asymptotic}M/T$* for H5690S at 180°C (Data for Figure 3.19 and 3.20).

$\dot{\gamma}$	$\dot{\gamma}$ M^2/T (x10^{-7})	ΔG* (x10^{-5})	ΔG*M/T (x10^{-7})	$G^*_{asymptotic}$ (x10^{-5})	$G^*_{asymptotic}M/T$ (x10^{-7})
6.45	7.80	7.00	11.4	5.00	9.80
2.58	3.12	2.50	4.08	2.00	2.61
1.75	2.12	1.00	1.63	1.00	1.63
1.47	1.78	0.90	1.47	0.80	1.31
1.05	1.27	0.30	0.49	0.40	0.65
1.20	1.45	0.20	0.33	0.20	0.33

Table B(5) *$\Delta G^*M/T$* and *$G^*_{asymptotic}M/T$* for H5603B at 180°C (Data for Figure 3.19 and 3.20).

$\dot{\gamma}$	$\dot{\gamma}$ M^2/T (x10^{-9})	ΔG* (x10^{-6})	ΔG*M/T (x10^{-9})	$G^*_{asymptotic}$ (x10^{-6})	$G^*_{asymptotic}M/T$ (x10^{-9})
13.50	8.69	2.30	2.74	2.30	2.74
3.00	1.93	1.20	1.43	1.00	1.19
1.50	0.97	0.45	0.54	0.30	0.36
0.35	0.22	0.17	0.20	0.20	0.24

Table B(6) *$\Delta G^*/T$* and *$G^*_{asymptotic}/T$* for H5690S at 160°C (Data for Figure 3.21 and 3.22).

$\dot{\gamma}$	$\dot{\gamma}\eta_o/T$ (x10^{-2})	ΔG^* (x10^{-5})	$\Delta G^*/T$ (x10^{-2})	$G^*_{asymptotic}$ (x10^{-5})	$G^*_{asymptotic}/T$ (x10^{-2})
2.40	11.10	4.00	9.24	1.50	3.46
1.50	6.93	2.00	4.62	1.00	2.31
0.60	2.77	1.00	2.31	0.70	1.62
0.18	0.83	0.50	1.15	0.30	0.69
0.09	0.42	0.20	0.46	0.20	0.46

Table B(7) *$\Delta G^*/T$* and *$G^*_{asymptotic}/T$* for H5690S at 180°C (Data for Figure 3.21 and 3.22).

$\dot{\gamma}$	$\dot{\gamma}\eta_o/T$ (x10^{-2})	ΔG^* (x10^{-5})	$\Delta G^*/T$ (x10^{-2})	$G^*_{asymptotic}$ (x10^{-5})	$G^*_{asymptotic}/T$ (x10^{-2})
6.45	8.12	7.00	15.5	5.00	11.00
2.58	3.25	2.50	5.52	2.00	4.42
1.75	2.20	1.00	2.21	1.00	2.21
1.47	1.85	0.90	1.99	0.80	1.77
1.05	1.32	0.30	0.66	0.40	8.83
1.20	1.51	0.20	0.44	0.20	4.42

Table B(8) *$\Delta G^*/T$* and *$G^*_{asymptotic}/T$* for H5603B at 180°C (Data for Figure 3.21 and 3.22).

$\dot{\gamma}$	$\dot{\gamma}\eta_o/T$ (x10^{-4})	ΔG^* (x10^{-6})	$\Delta G^*/T$ (x10^{-3})	$G^*_{asymptotic}$ (x10^{-6})	$G^*_{asymptotic}/T$ (x10^{-3})
13.50	7.45	2.30	5.08	2.30	5.08
3.00	1.66	1.20	2.65	1.00	2.21
1.50	0.83	0.45	0.99	0.30	0.66
0.35	0.19	0.17	0.38	0.20	0.44

APPENDIX C
SLIP VELOCITY AND SLIP LENGTH

Table C(1) Slip velocity and slip length for H5690S at 160°C (Data for Figure 3.23 (a) and (b)).

30%Strain		70%Strain		150%Strain	
V_s (cm/s)	b (cm)	V_s (cm/s)	b (cm)	V_s (cm/s)	b (cm)
0.020	0.0106	0.027	0.0362	0.015	0.0288
0.026	0.0109	0.028	0.0203	0.057	0.0063
0.100	0.0105	0.031	0.0116	0.283	0.0020
0.267	0.0114	0.063	0.0071	0.100	0.0036
0.050	0.0106	0.113	0.0017	-	-

Table C(2) Slip velocity and slip length for H5690S at 180°C (Data for Figure 3.23 (a) and (b)).

30%Strain		70%Strain		150%Strain	
V_s (cm/s)	b (cm)	V_s (cm/s)	b (cm)	V_s (cm/s)	b (cm)
0.024	0.0116	0.009	0.0074	0.0053	0.0057
0.027	0.0119	0.035	0.0074	0.0308	0.0032
0.040	0.0116	0.427	0.0072	0.1256	0.0008
0.283	0.0123	-	-	-	-

APPENDIX D

ANOMALOUS DATA AT 200°C

Table D(1) Critical frequencies for G^* decays and rises for H5690S at 200°C (Data for Figure 3.30 (a)).

Strain (%)	G^* rises			G^* decays		
	ω_r^*		SD	ω_d^*		SD
20	19.0	-	-	45.0	-	-
30	10.0	9.0	0.7	20.0	-	-
50	4.0	-	-	11.0	-	-
70	1.0	-	-	5.0	-	-
150	0.3	-	-	2.0	-	-

Table D(2) Critical stresses for G^* decays and rises for H5690S at 200°C (Data for Figure 3.30 (b)).

Strain (%)	G^* rises			G^* decays		
	σ_r^* ($\times10^{-5}$)		SD	σ_d^* ($\times10^{-5}$)		SD
20	1.06	-	-	2.60	-	-
30	0.90	0.88	0.01	2.70	-	-
50	0.84	-	-	2.65	-	-
70	0.62	-	-	2.75	-	-
150	0.46	-	-	2.14	-	-

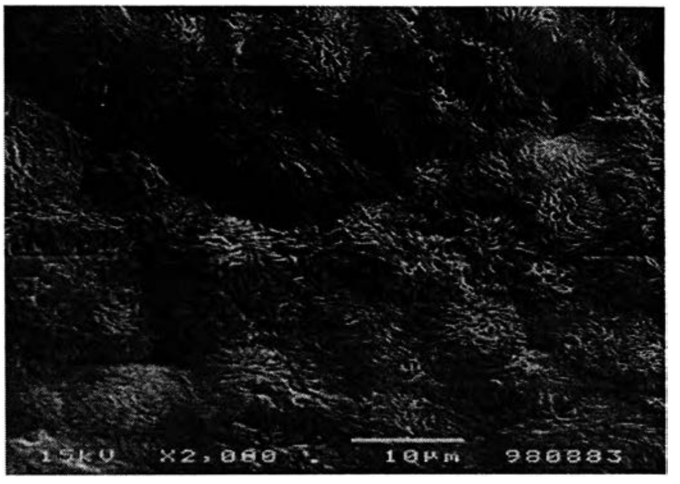

Figure D(1) SEM micrograph of H5690S after having been sheared at its critical condition at 200°C.

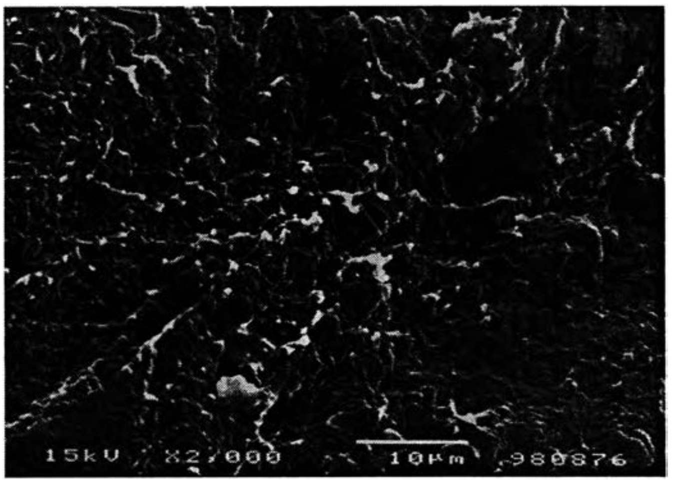

Figure D(2) SEM micrograph of H5690S after having been sheared above its critical condition at 200°C.

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