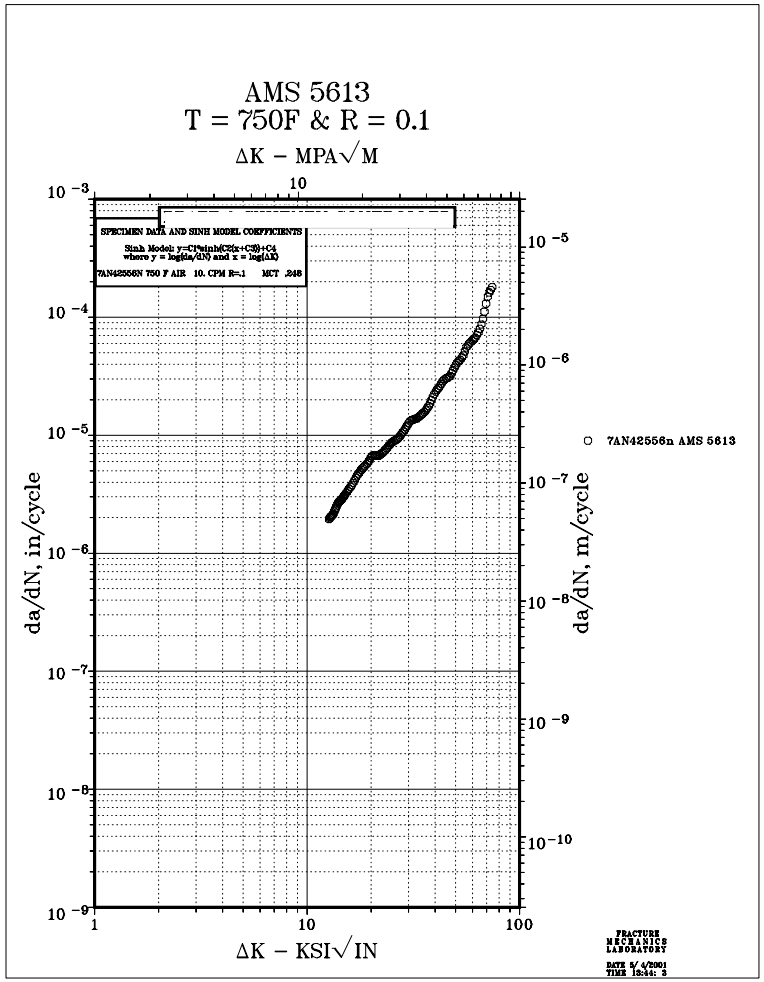
APPENDIX A—DATA AND DATA PLOTS OF da/dN TESTS

A.1 AMS 5613 da/dN PLOTS.

Chart No.	Material Source	Condition[2]	Specimen Number	Test Temp. (^oF)	Cyclic Rate	Comments
A-1	A	A	42556	750	10 cpm	Baseline
A-2	A	A	42557	950	10 cpm	Baseline
A-3	A	A	42558	950	10 cpm	Baseline
A-4	A	A	42559	950	2 mdw	Baseline
A-5	A	A	42560	950	2 mdw	Baseline
A-6	A	B	42562	750	10 cpm	Weld Baseline
A-7	A	B	42563	950	10 cpm	Weld Baseline
A-8	A	B	42564	950	10 cpm	Weld Baseline
A-9	A	B	42565	950	2 mdw	Weld Baseline
A-10	A	B	42566	950	2 mdw	Weld Baseline
A-11	A	C	43346	750	10 cpm	Effect of multi-SR's on BM
A-12	A	C	43347	750	10 cpm	Effect of multi-SR's on BM
A-13	A	C	43348	950	10 cpm	Effect of multi-SR's on BM
A-14	A	C	43349	950	10 cpm	Effect of multi-SR's on BM
A-15	A	C	43350	950	2 mdw	Effect of multi-SR's on BM
A-16	A	C	43351	950	2 mdw	Effect of multi-SR's on BM
A-17	A	D	43352	750	10 cpm	Effect of multi-SR's on Welds
A-18	A	D	43353	750	10 cpm	Effect of multi-SR's on Welds
A-19	A	D	43354	950	10 cpm	Effect of multi-SR's on Welds
A-20	A	D	43355	950	10 cpm	Effect of multi-SR's on Welds
A-21	A	D	43357	950	2 mdw	Effect of multi-SR's on Welds
A-22	A	A	45107	RT	10 cpm	RT Fracture Eval.
A-23	A	E	43335	RT	10 cpm	RT Fracture Eval.
A-24	A	A	45108	RT	10 cpm	RT Fracture Eval.; R=0.5
A-25	A	E	43336	RT	10 cpm	RT Fracture Eval.; R=0.5

Notes: 1. Rolled Ring: Heat ZCESS
2. A: Harden+Temper+1 Stress Relief Cycle
B: Harden+Temper+Weld+1 Stress Relief Cycle
C: Harden+Temper+16 Stress Relief Cycles. D: Harden+Temper+Weld+16 Stress relief Cycles
D: Harden+Temper+8 Stress Relief Cycles



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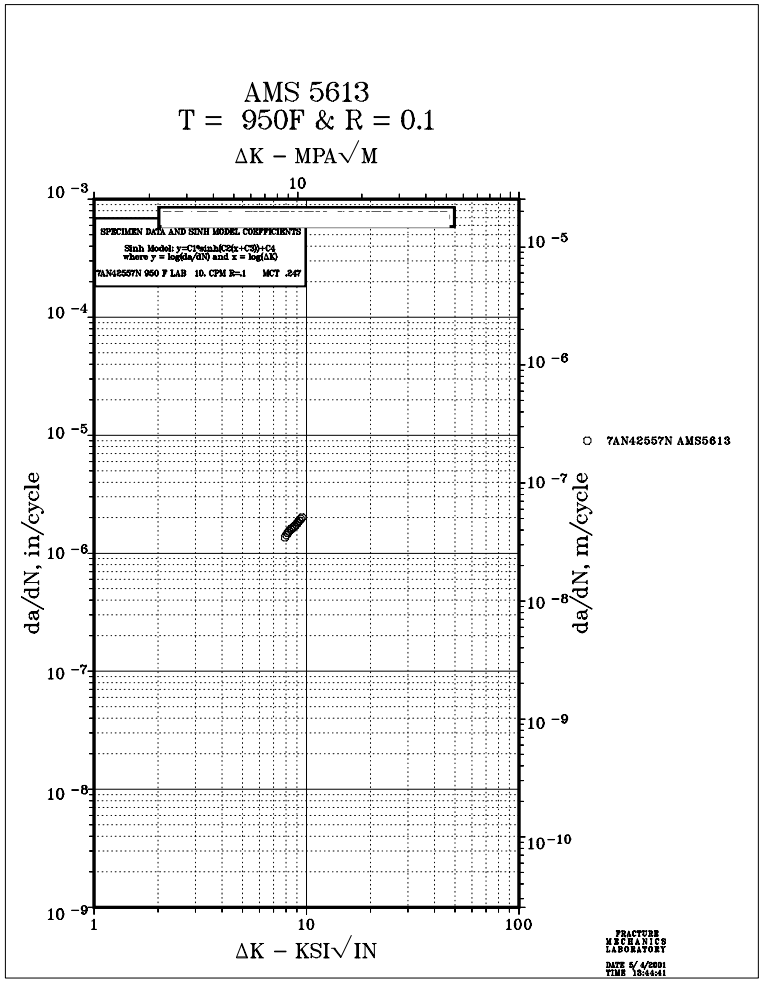

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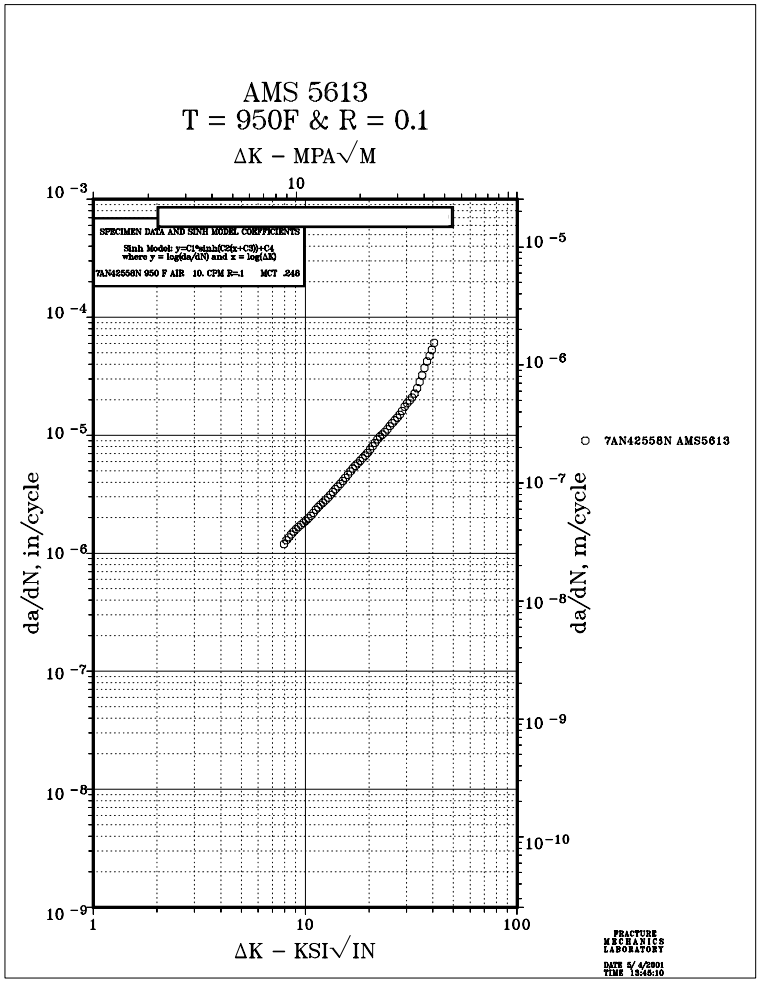

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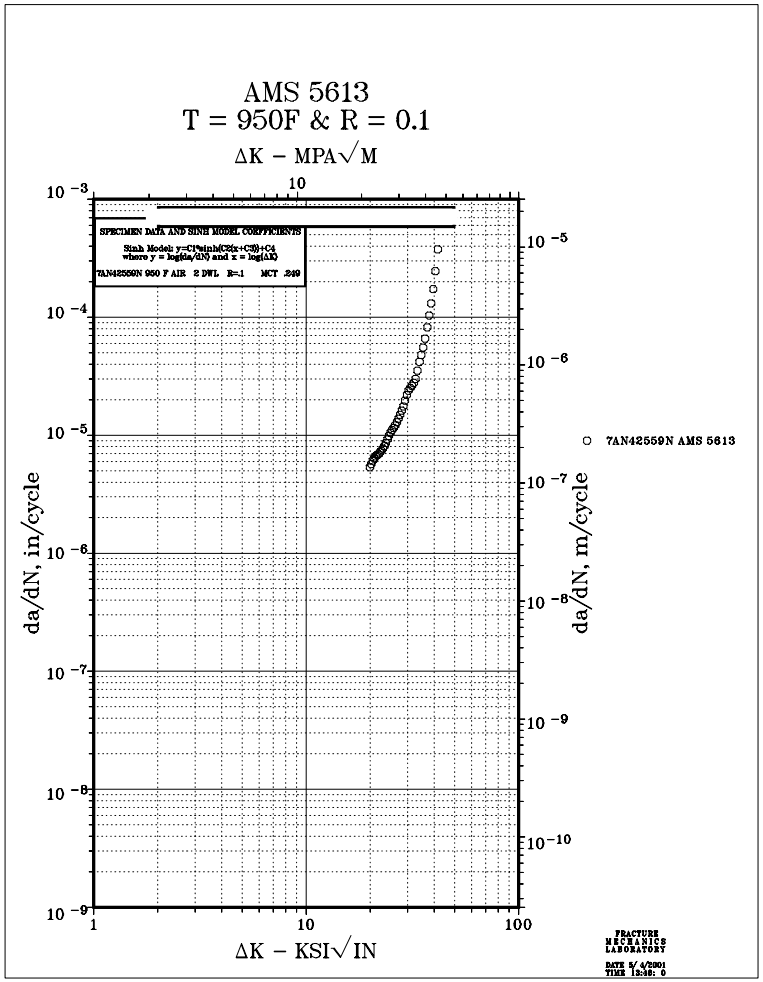

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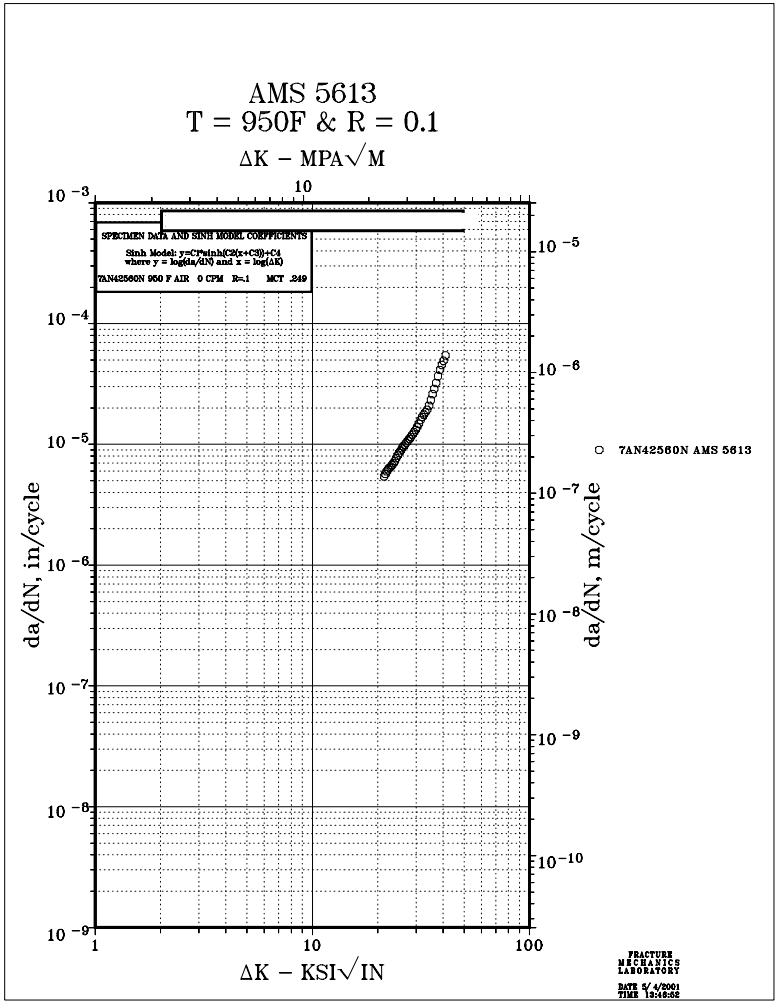

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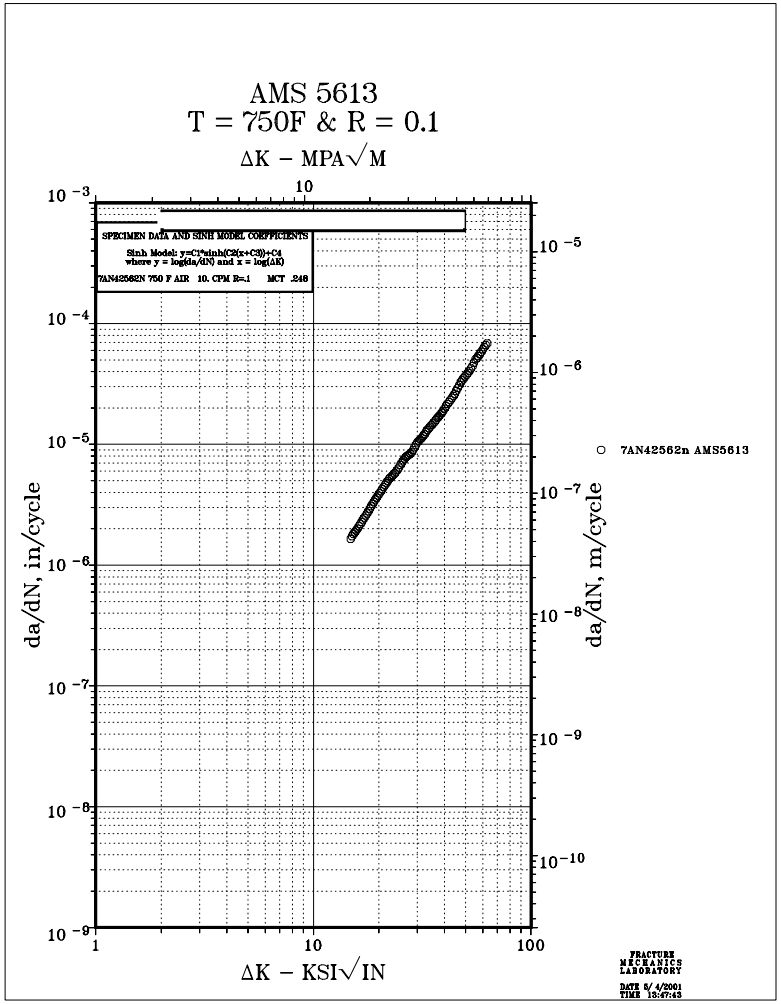

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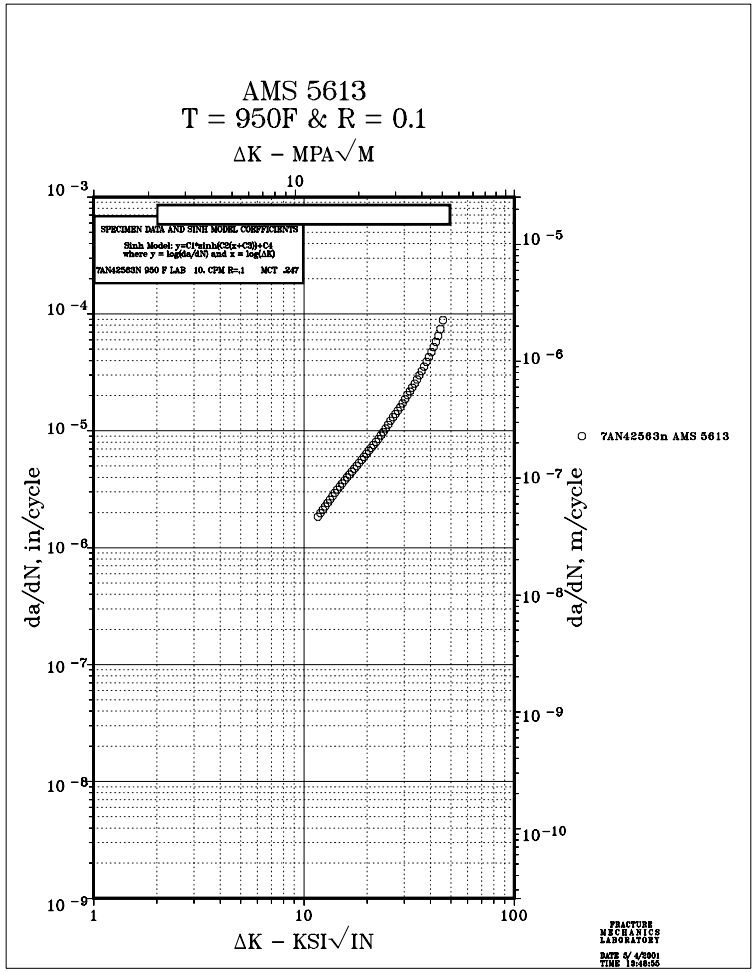

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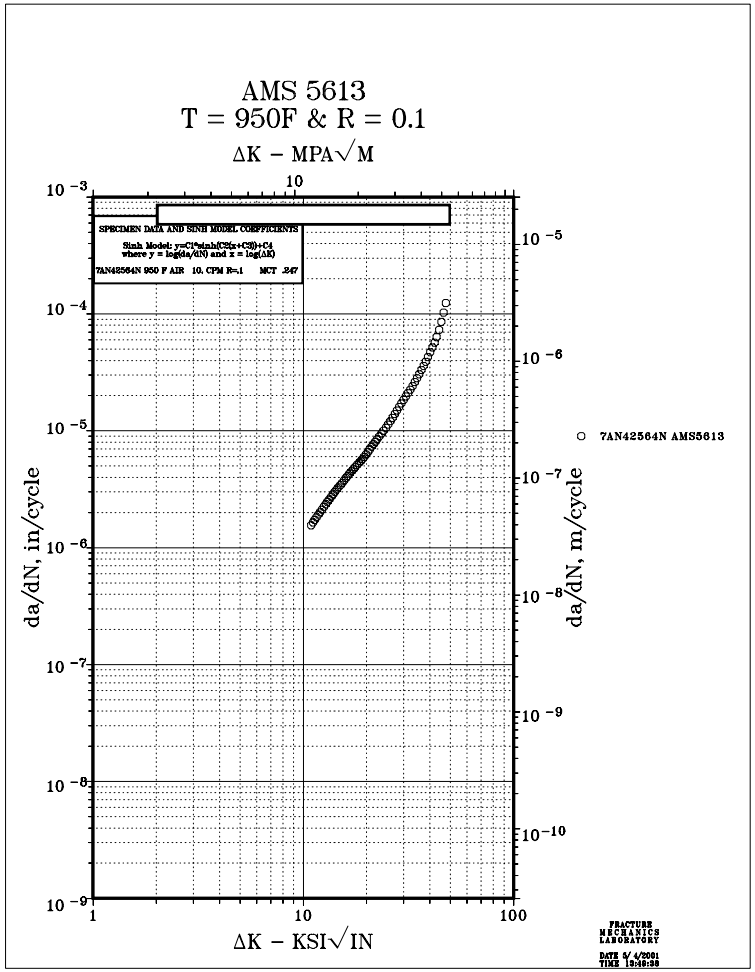

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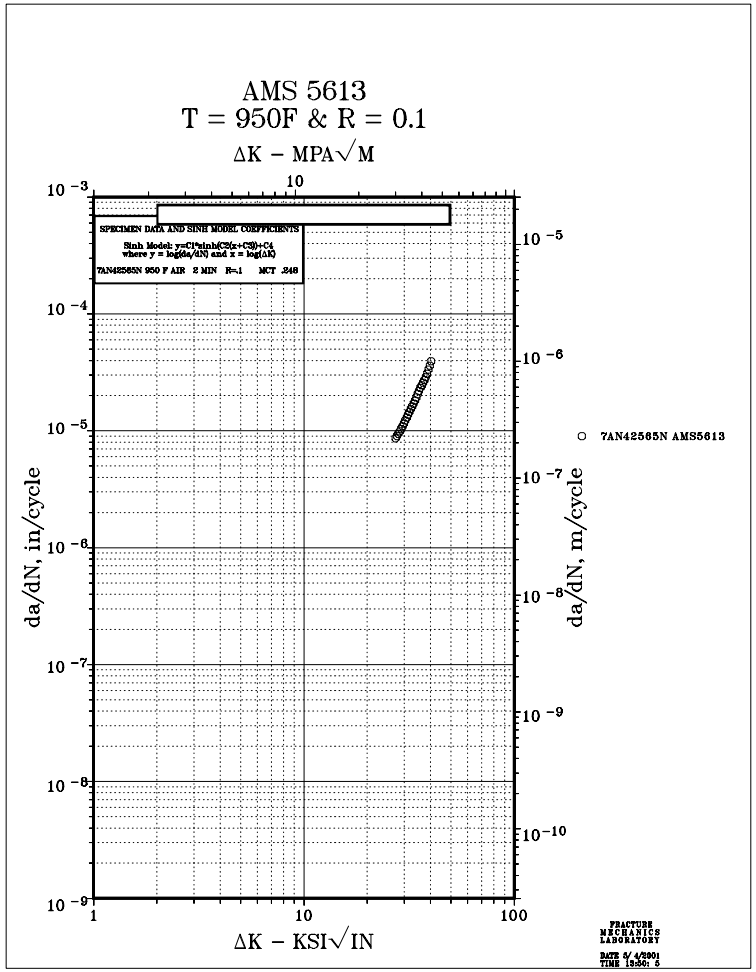

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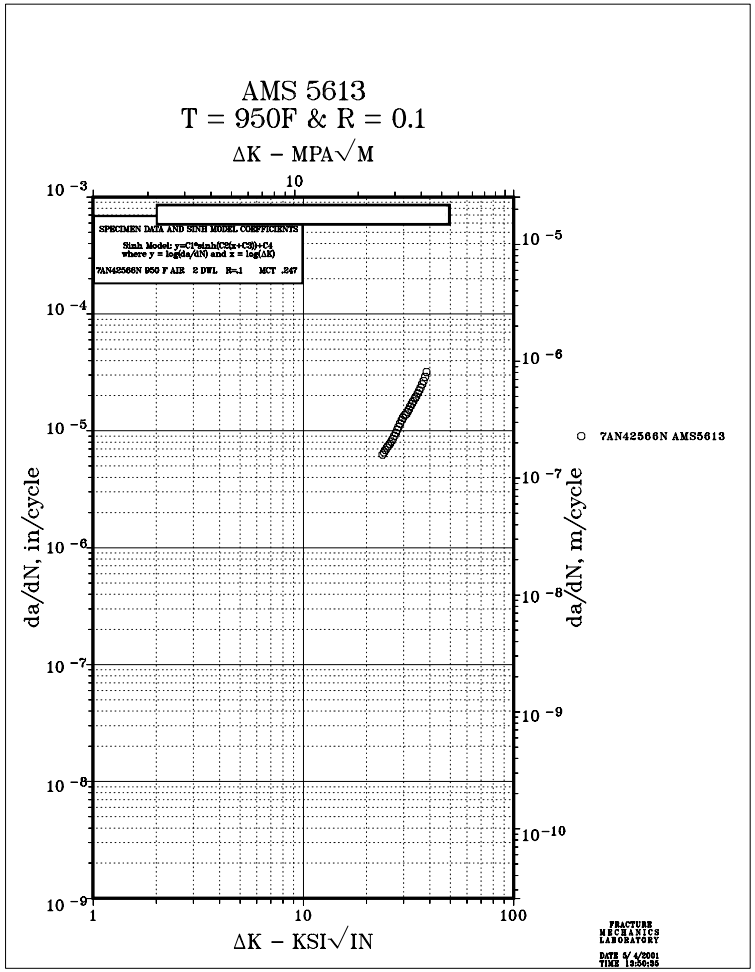

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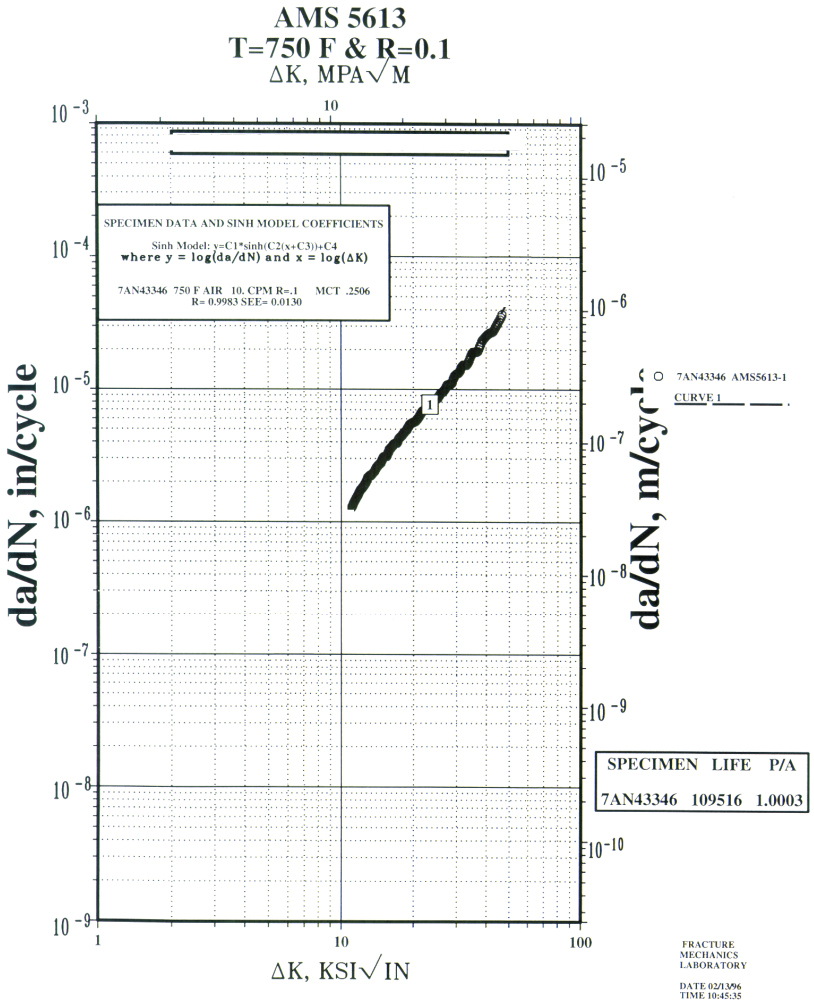

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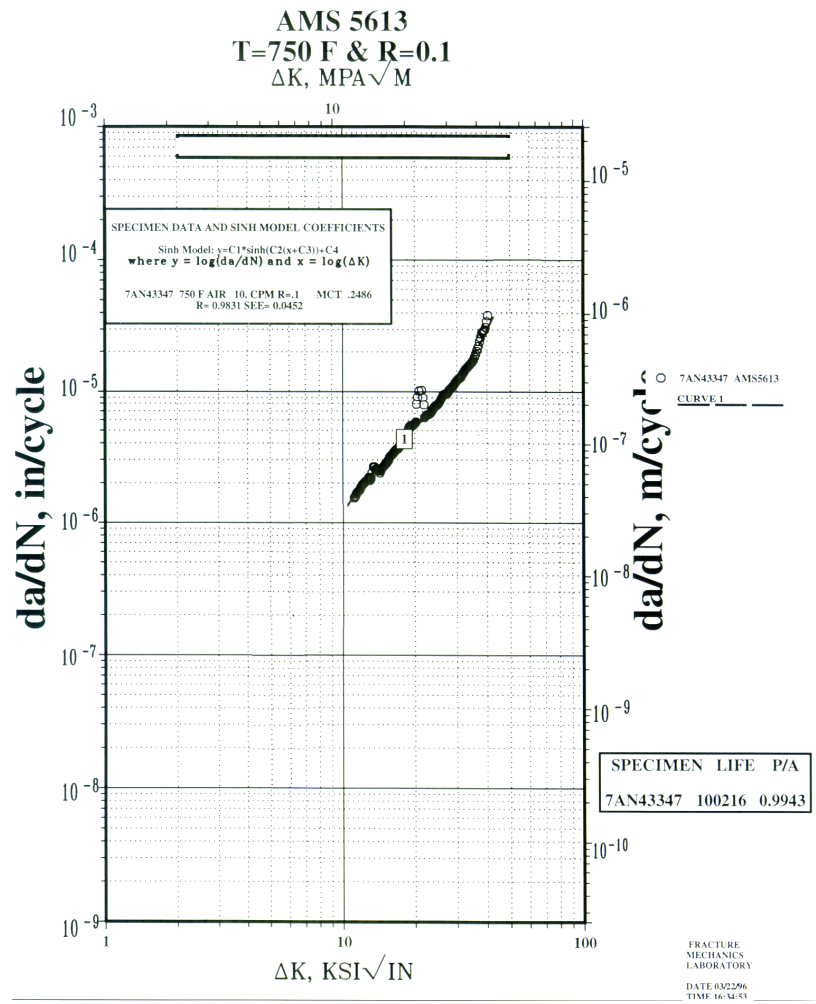

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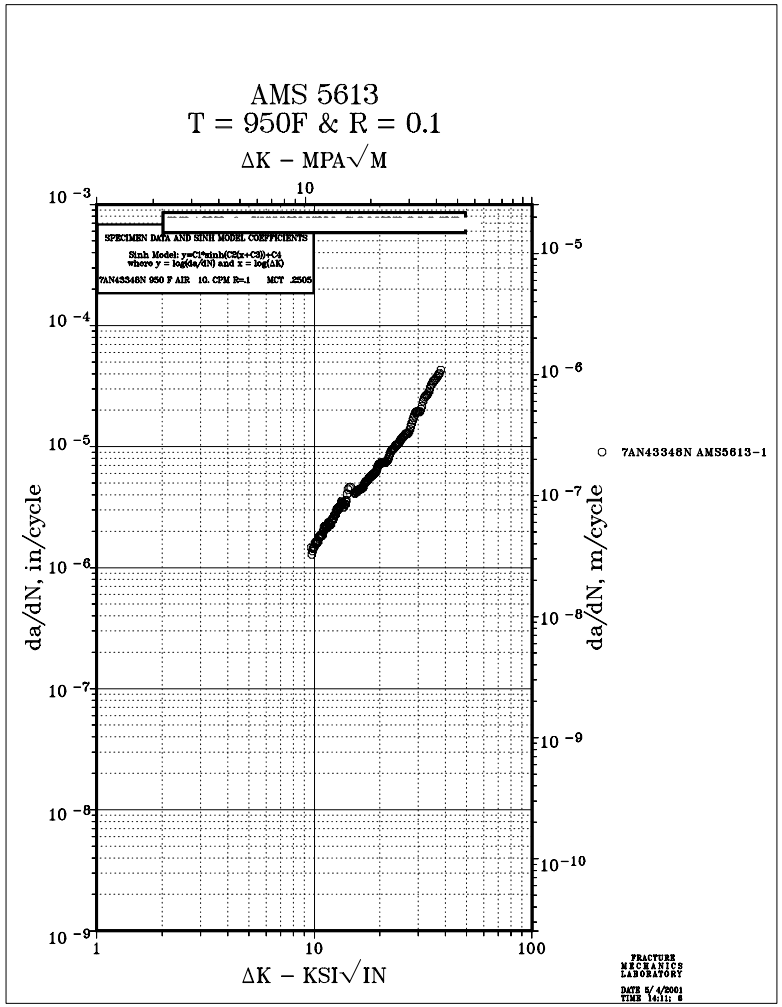

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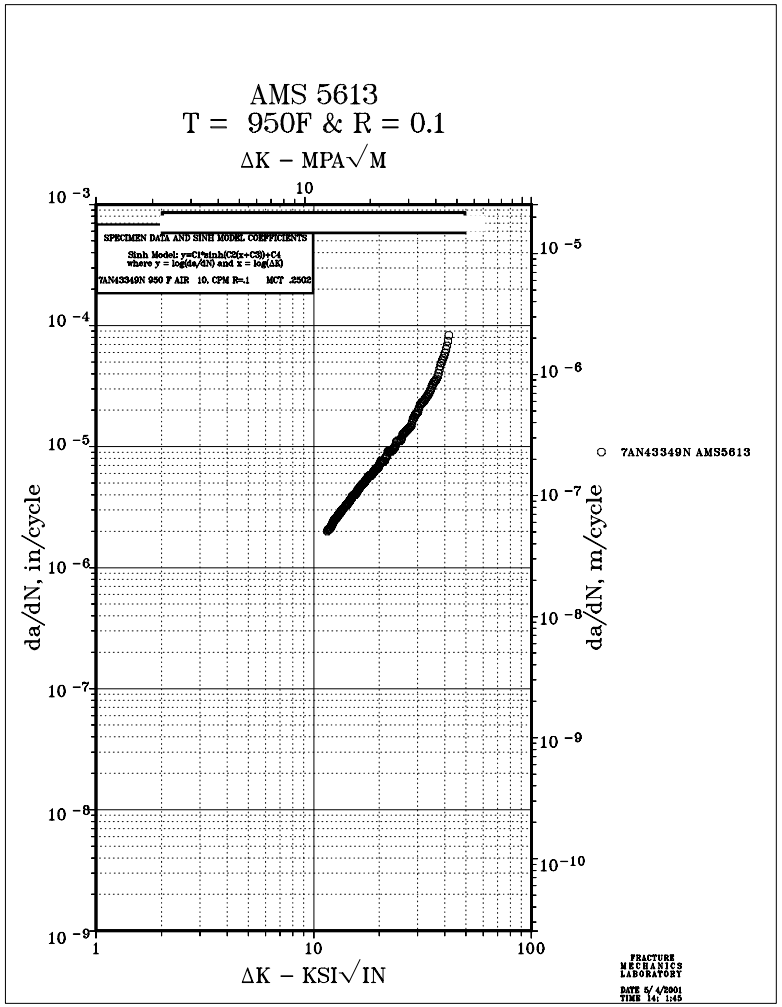

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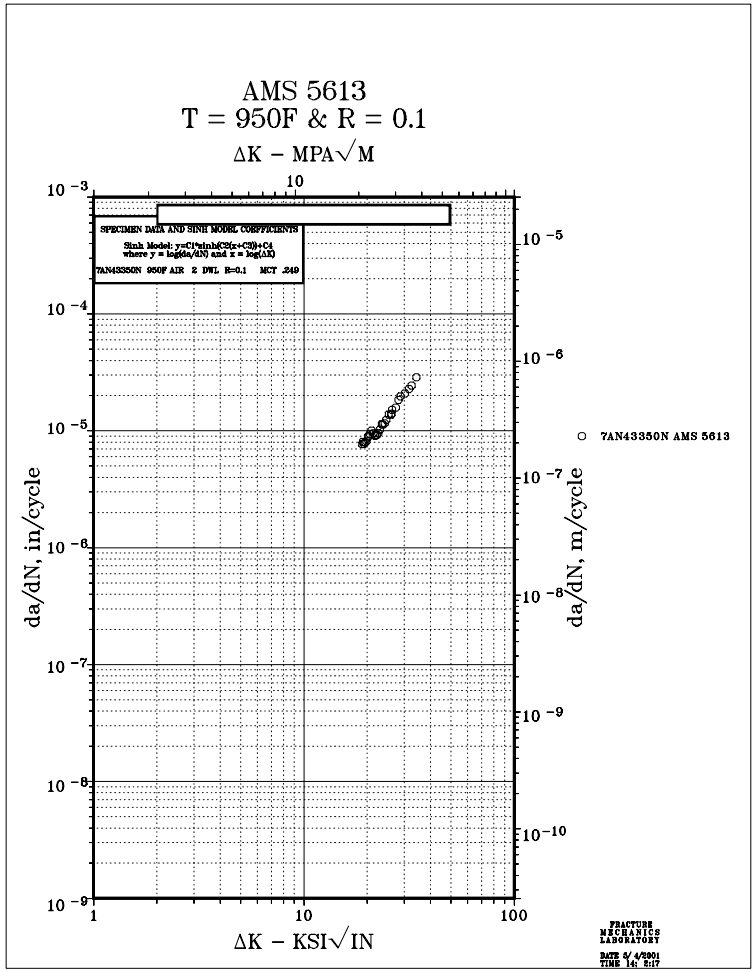

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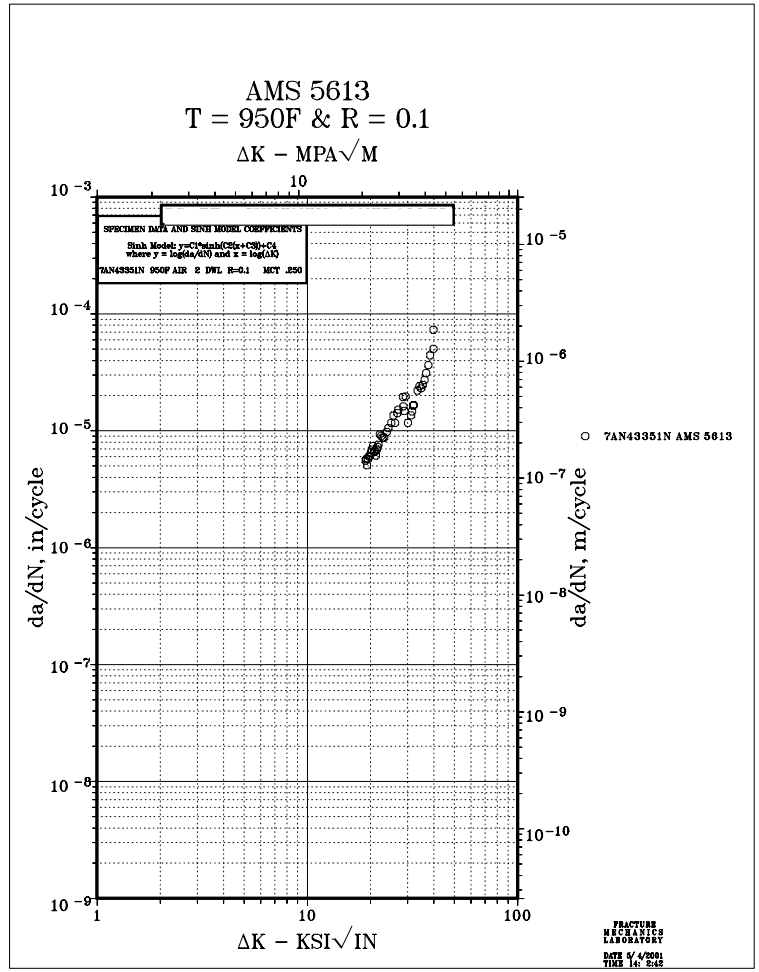

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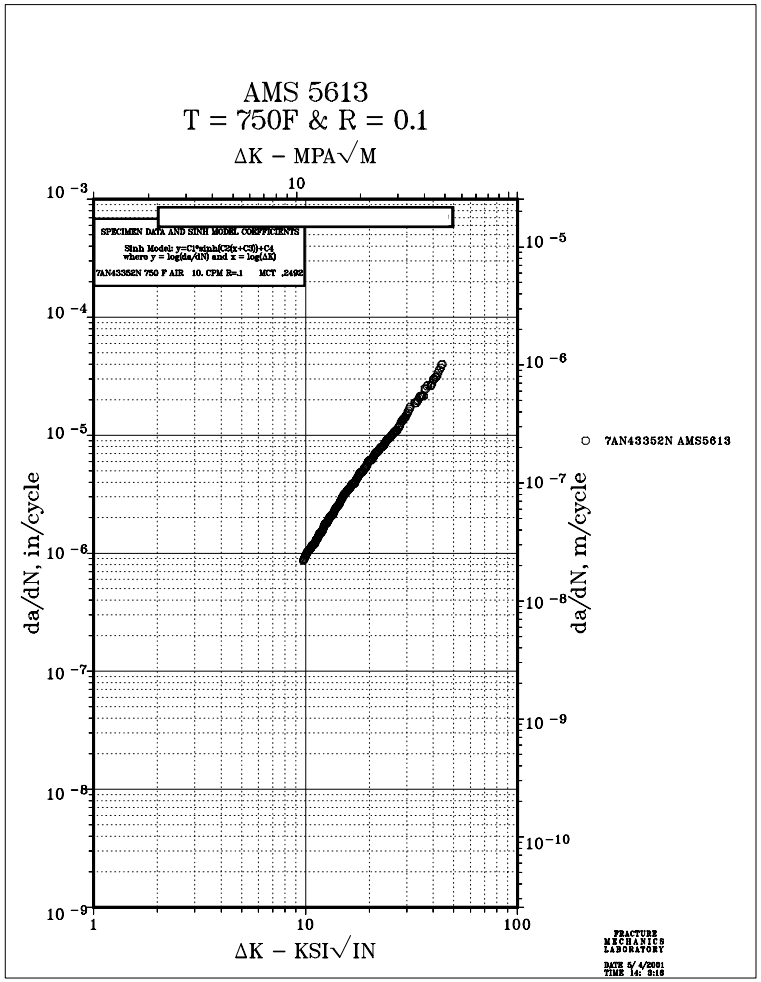

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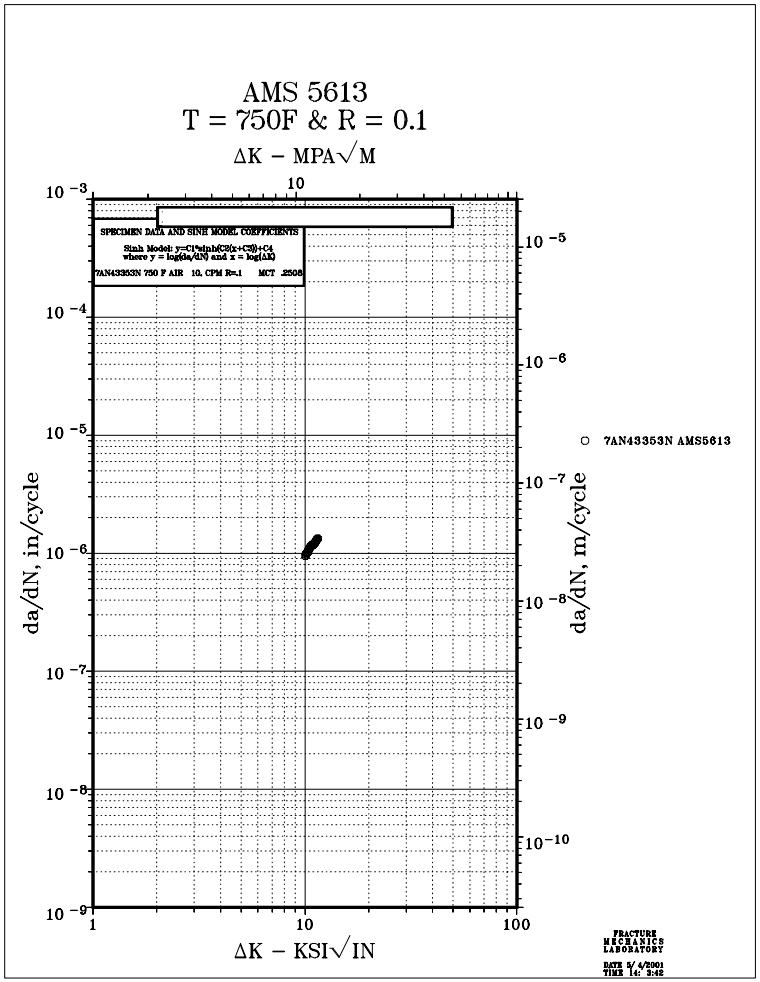

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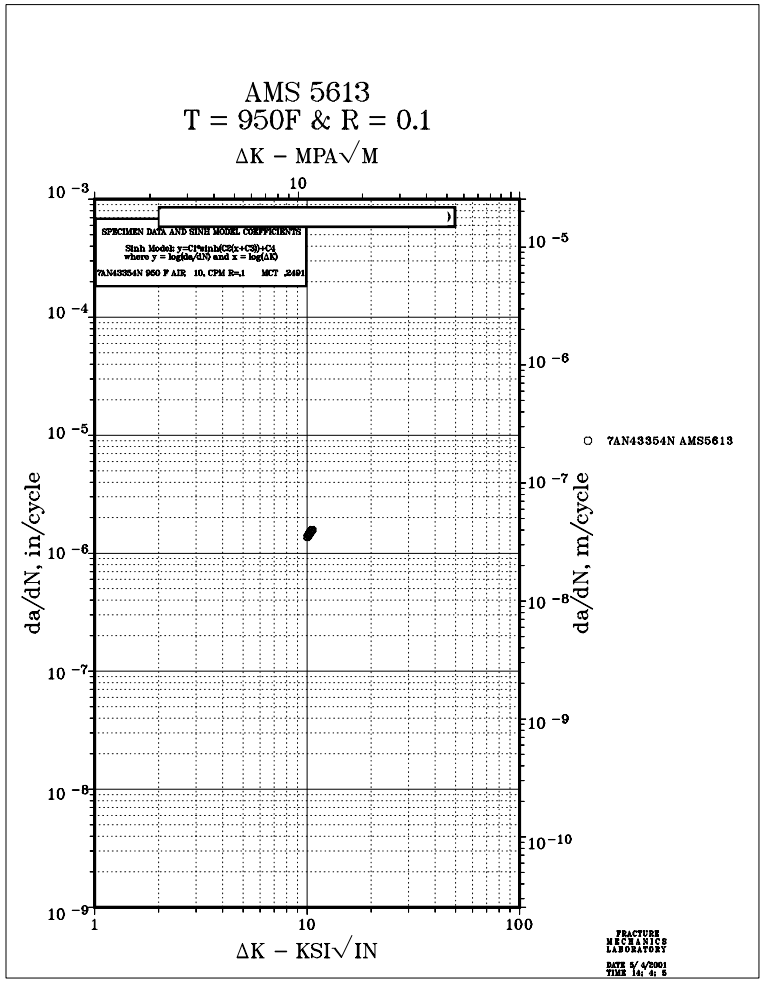

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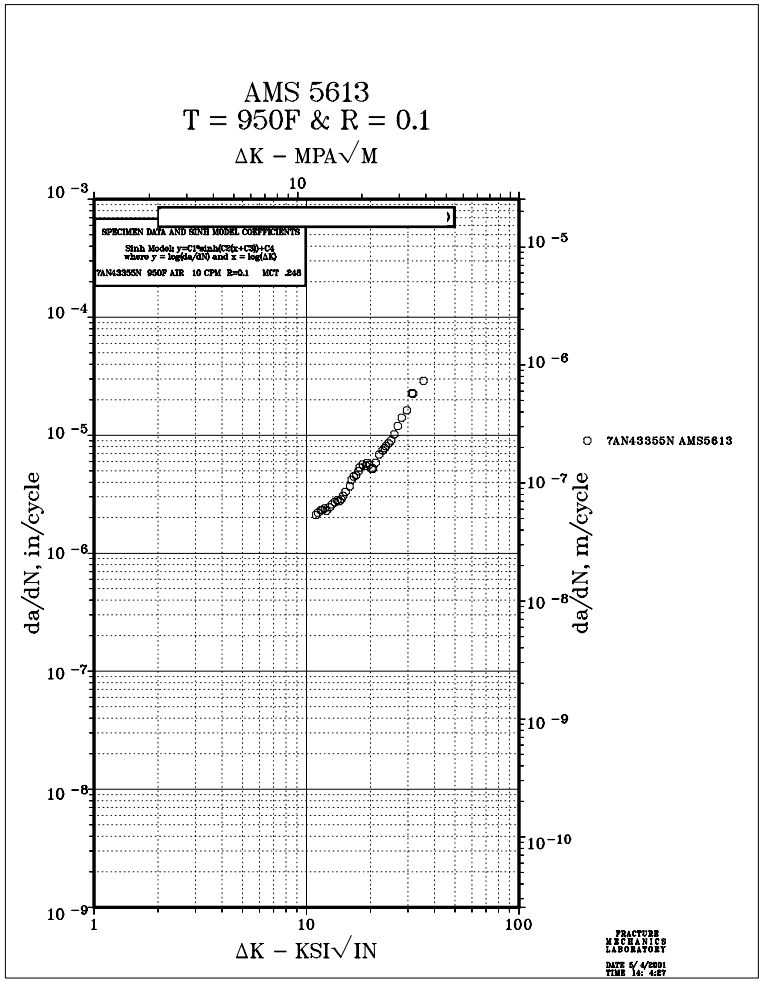

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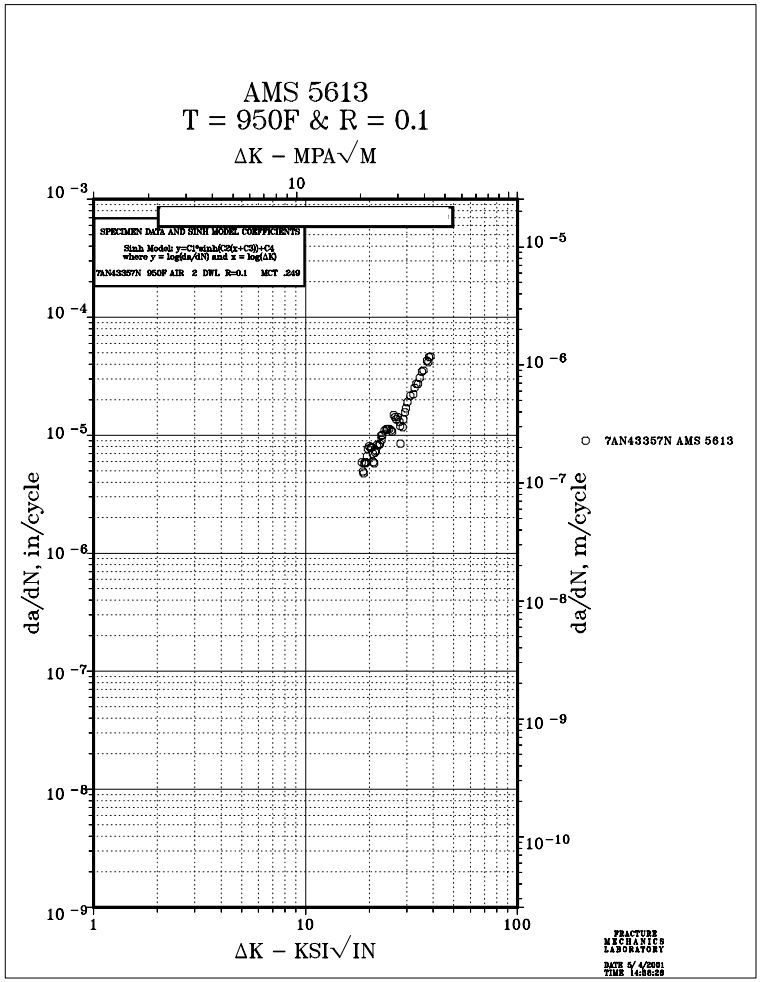

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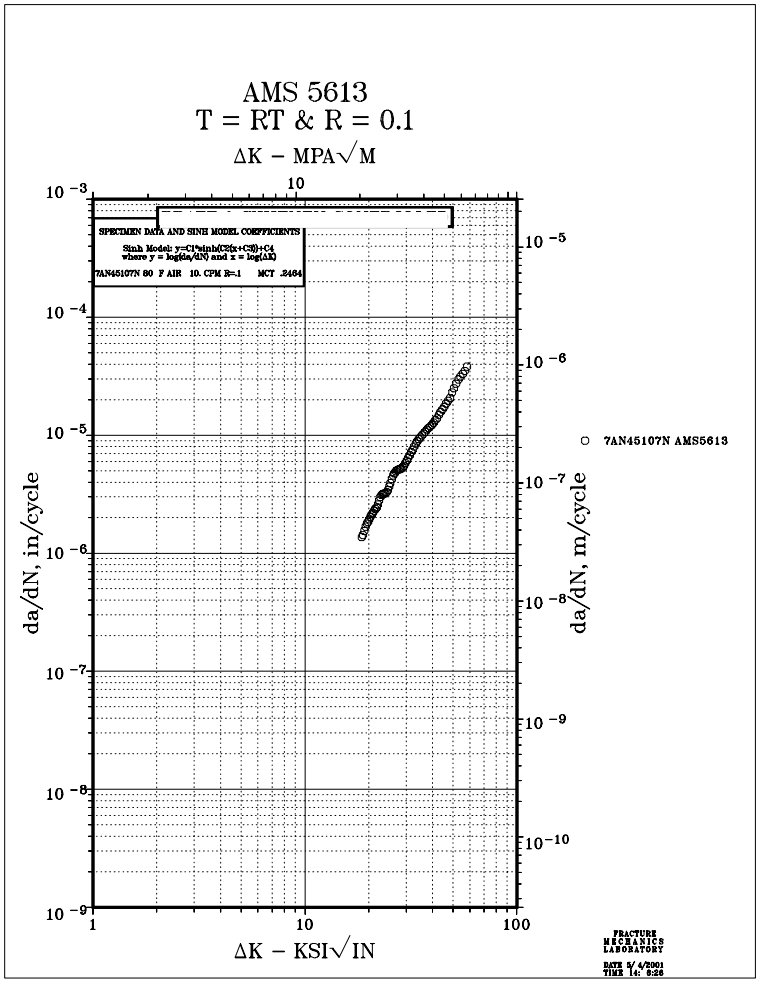

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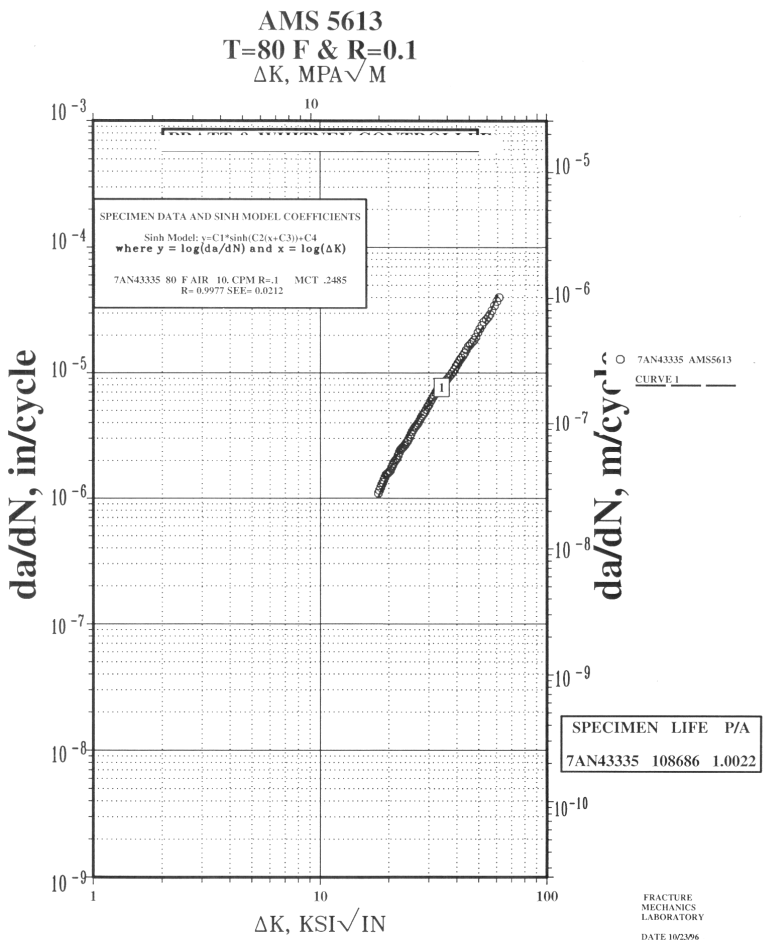

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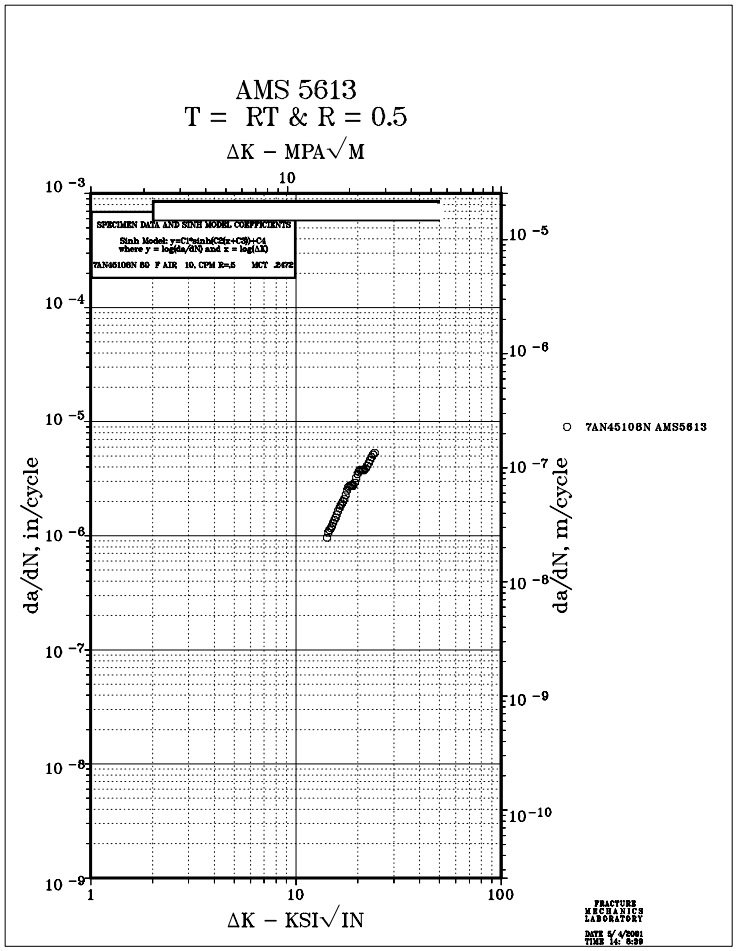

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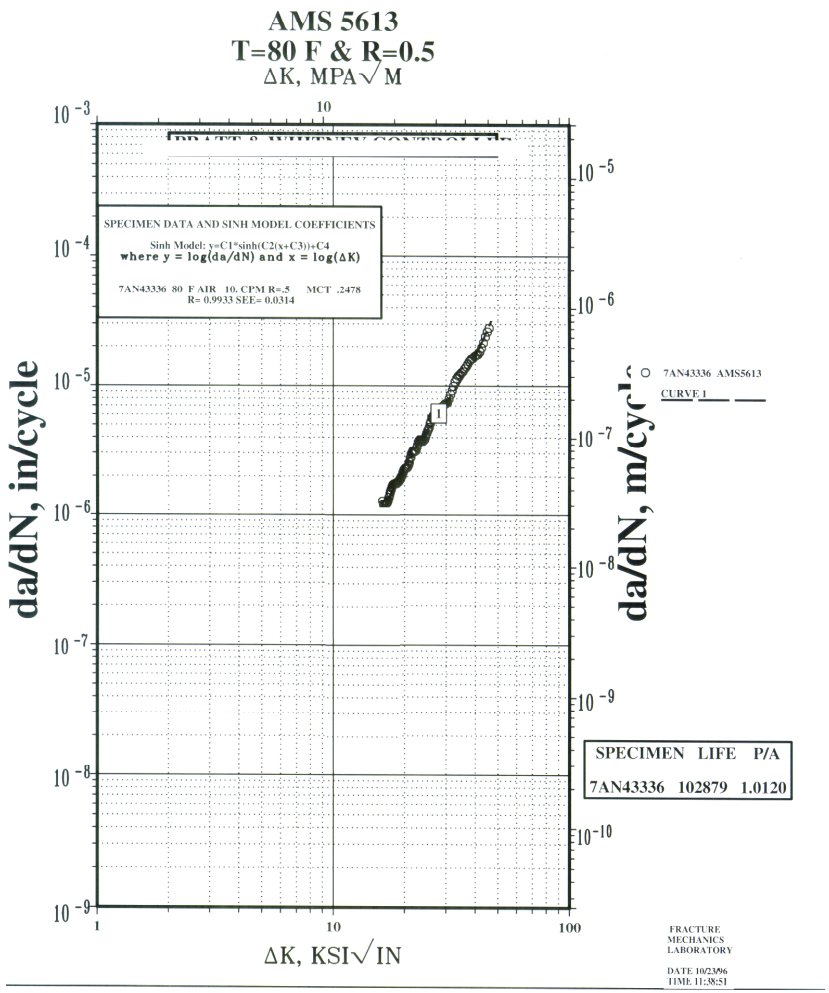
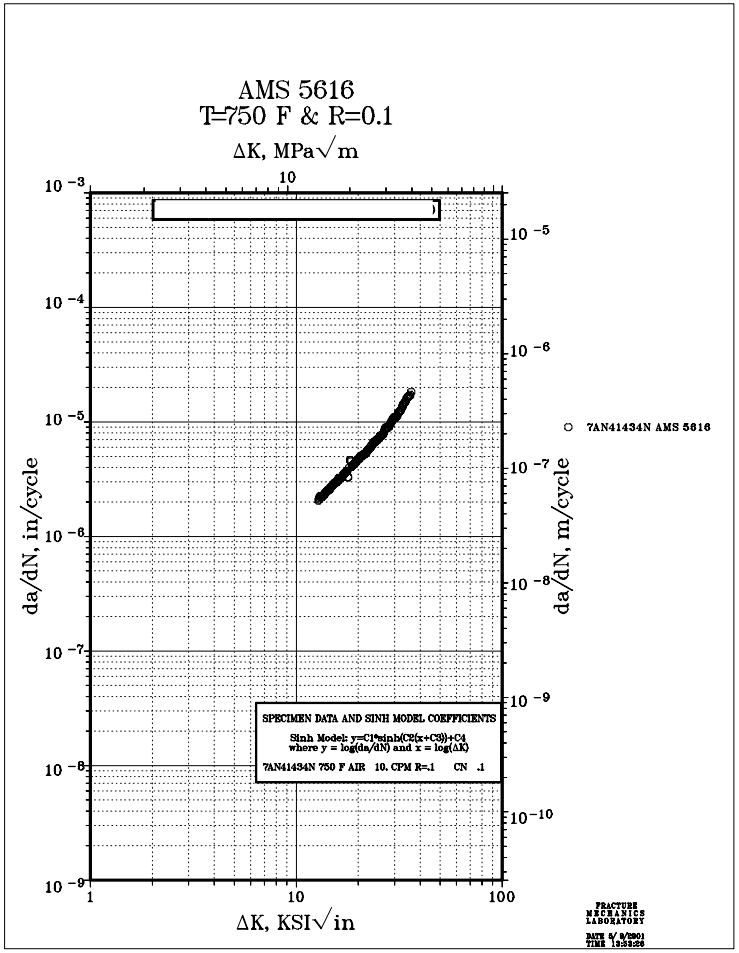

AMS 5613
T=80 F & R=0.5
ΔK, MPA√M
SPECIMEN DATA AND SINH MODEL COEFFICIENTS
Sinh Model: y=C1*sinh(C2(x+C3))+C4
where y = log(da/dN) and x = log(ΔK)
7AN43336 80 F AIR 10. CPM R=.5 MCT .2478
R= 0.9933 SEE= 0.0314
da/dN, in/cycle
da/dN, m/cycle
ΔK, KSI√IN
7AN43336 AMS5613
CURVE 1
SPECIMEN LIFE P/A
7AN43336 102879 1.0120
FRACTURE
MECHANICS
LABORATORY
DATE 10/23/96
TIME 11:38:51

Chart A-25

A.2. AMS 5616 da/dN PLOTS.

No.	Material Source[1]	Condition[2]	Specimen Number	Test Temp.(°F)	Cyclic Rate	Comments[2]
A-26	A	A	41434	750	10 cpm	Trueform Baseline
A-27	A	A	41436	750	10 cpm	Trueform Baseline
A-28	A	A	41435	950	10 cpm	Trueform Baseline
A-29	A	A	41437	950	10 cpm	Trueform Baseline
A-30	B	A	40846	950	10 cpm	GS/Orientation Eval.; FG-L
A-31	B	A	40848	950	10 cpm	GS/Orientation Eval.; FG-T
A-32	B	A	40847	950	2 mdw	GS/Orientation Eval.; FG-L
A-33	B	A	40849[5]	950	2 mdw	GS/Orientation Eval.; FG-T
A-34	B	A	40850	950	10 cpm	GS/Orientation Eval.; CG-L
A-35	B	A	40852[6]	950	10 cpm	GS/Orientation Eval.; CG-T
A-36	B	A	40851[5]	950	2 mdw	GS/Orientation Eval.; CG-L
A-37	B	A	40853	950	2 mdw	GS/Orientation Eval.; CG-T
A-38	B	B	42336[4]	750	10 cpm	Baseline[4]
A-39	B	B	42337	950	2 mdw	Baseline[4]
A-40	B	C	42339	750	10 cpm	Weld baseline
A-41	B	C	42341	950	2 mdw	Weld baseline
A-42	B	D	43124	750	10 cpm	Effect of multi-SR's on BM
A-43	B	D	43125	950	2 mdw	Effect of multi-SR's on BM
A-44	B	E	43127	750	10 cpm	Effect of multi-SR's on BM Welds
A-45	B	E	43128	950	2 mdw	Effect of multi-SR's on BM Welds
A-46	B	A	44805	850	10 cpm	850F Eval.; CG-T
A-47	B	A	44804	850	2 mdw	850F Eval.; CG-L
A-48	B	B	42340	1200	2 mdw	1200F test

Notes: 1. Rolled Ring Heat ZCLPT
2. A: Harden+Temper
B: Harden+Temper+1 Stress Relief Cycle
C: Harden+Temper+Weld+ 1 Stress Relief Cycle
D: Harden+Temper+16 Stress Relief Cycles
E: Harden+Temper+Weld + 16 Stress Relief Cycles
3. FG= fine grain, CG = coarse grain, L = longitudinal orientation, T = transverse orientation
4. Rig failure; no data
5. Questionable test results.
6. Electronic record of data was lost.



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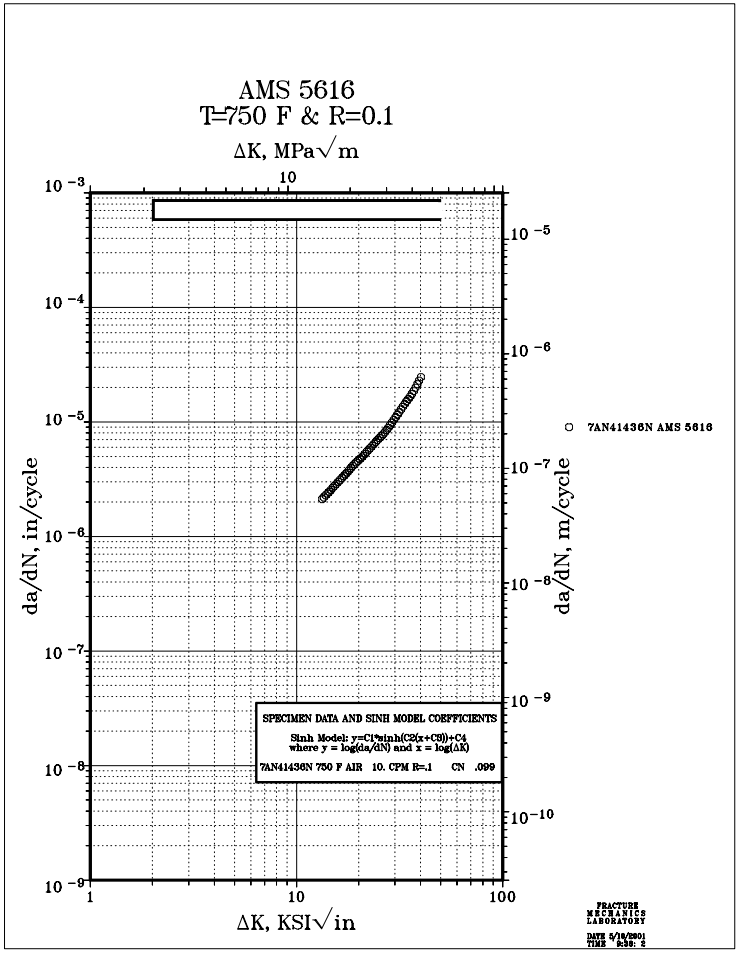

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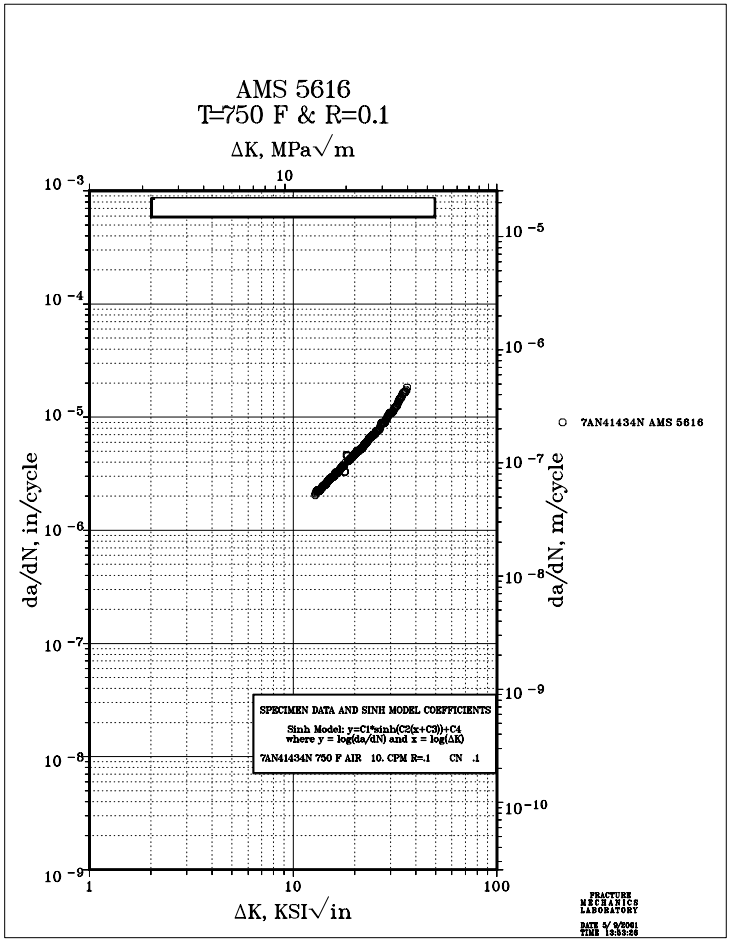

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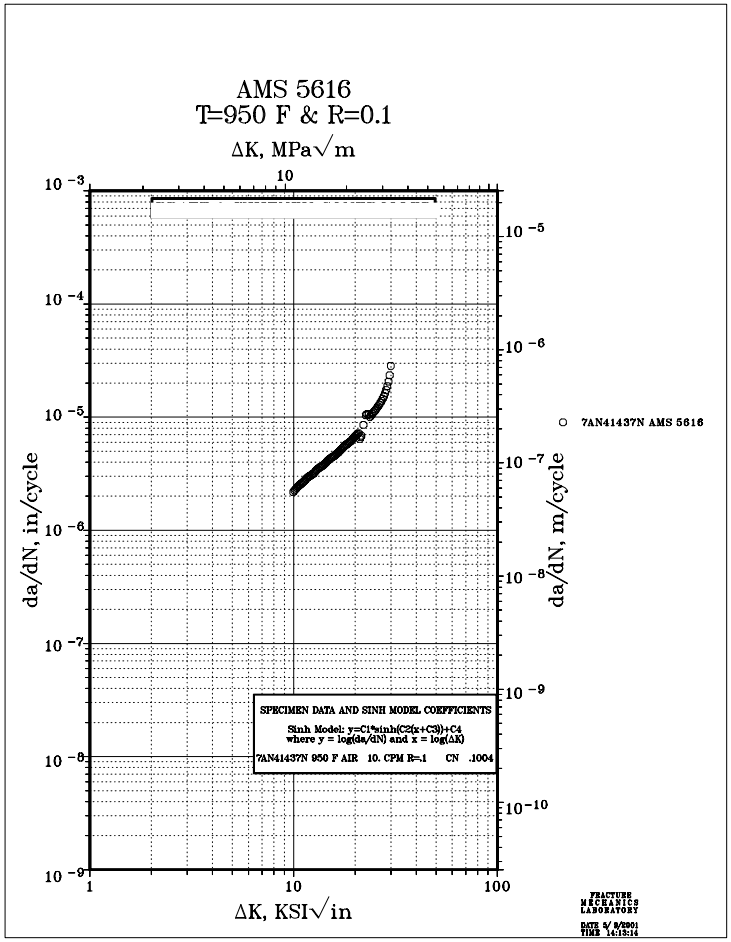

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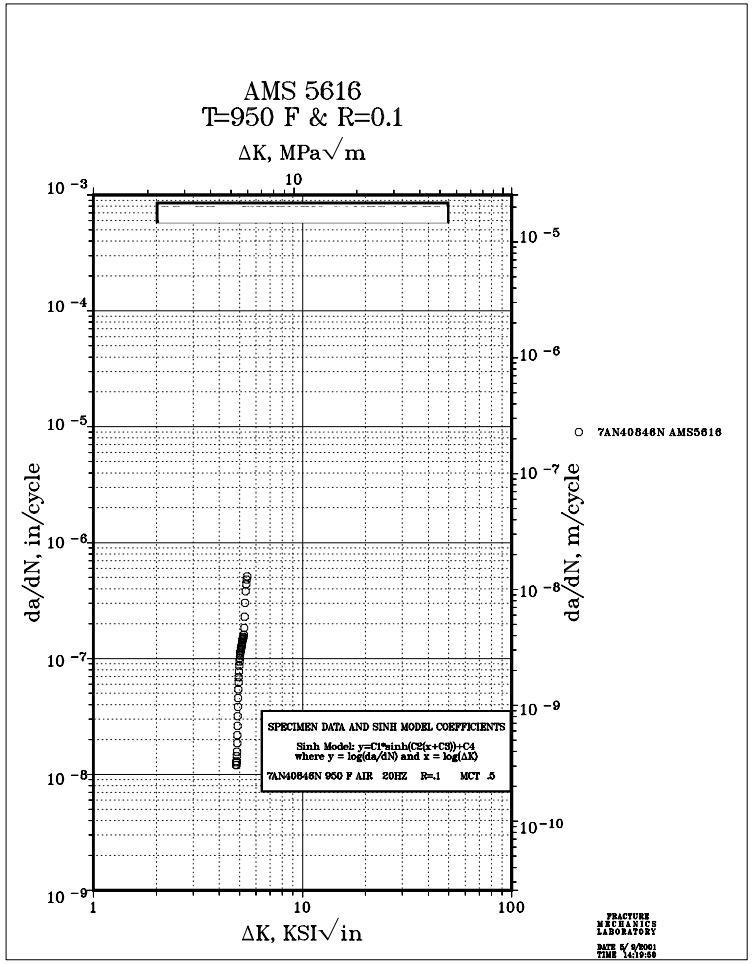

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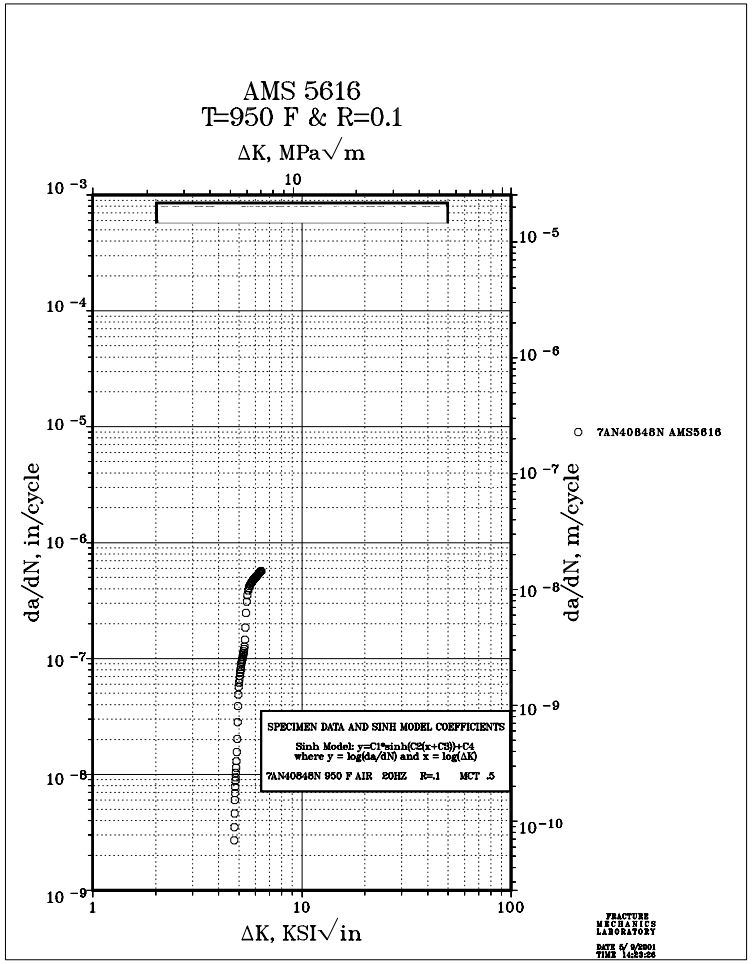

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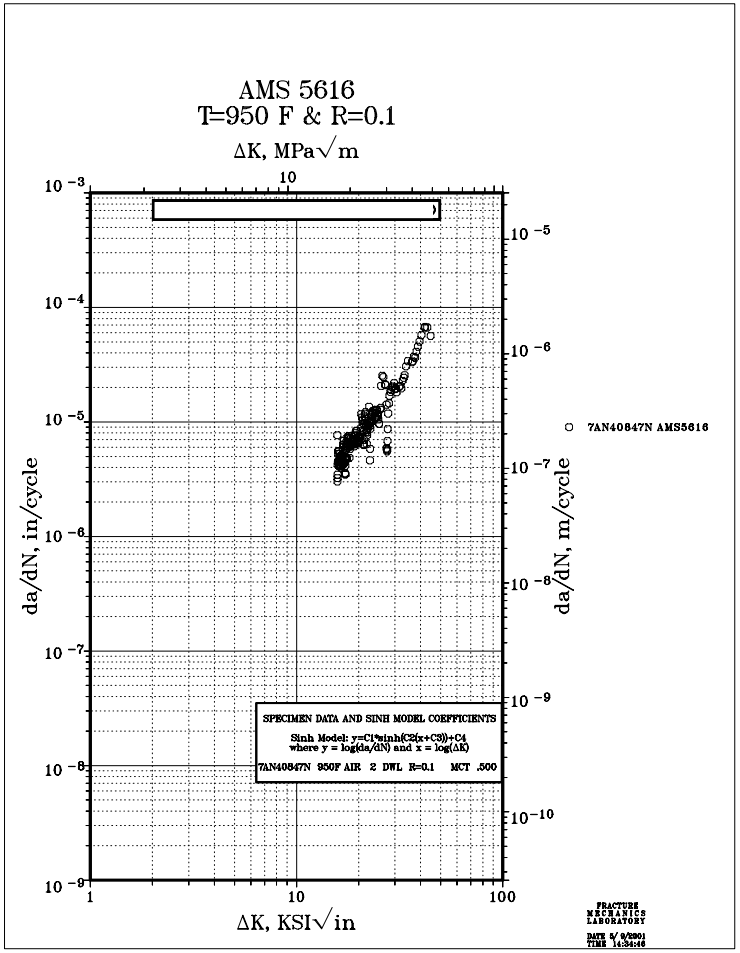

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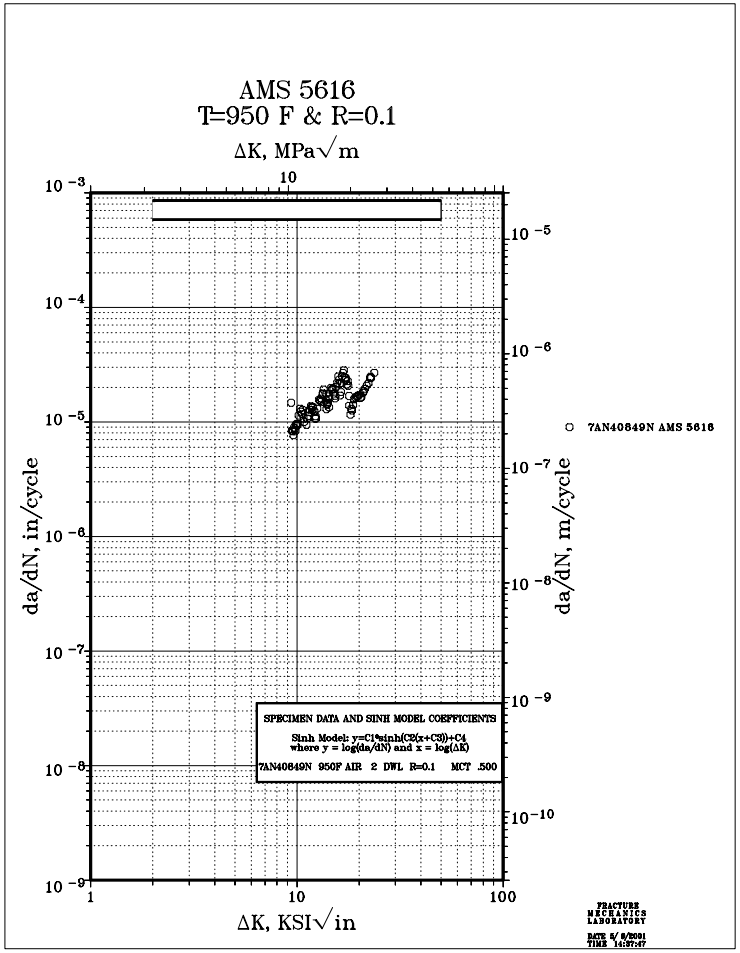

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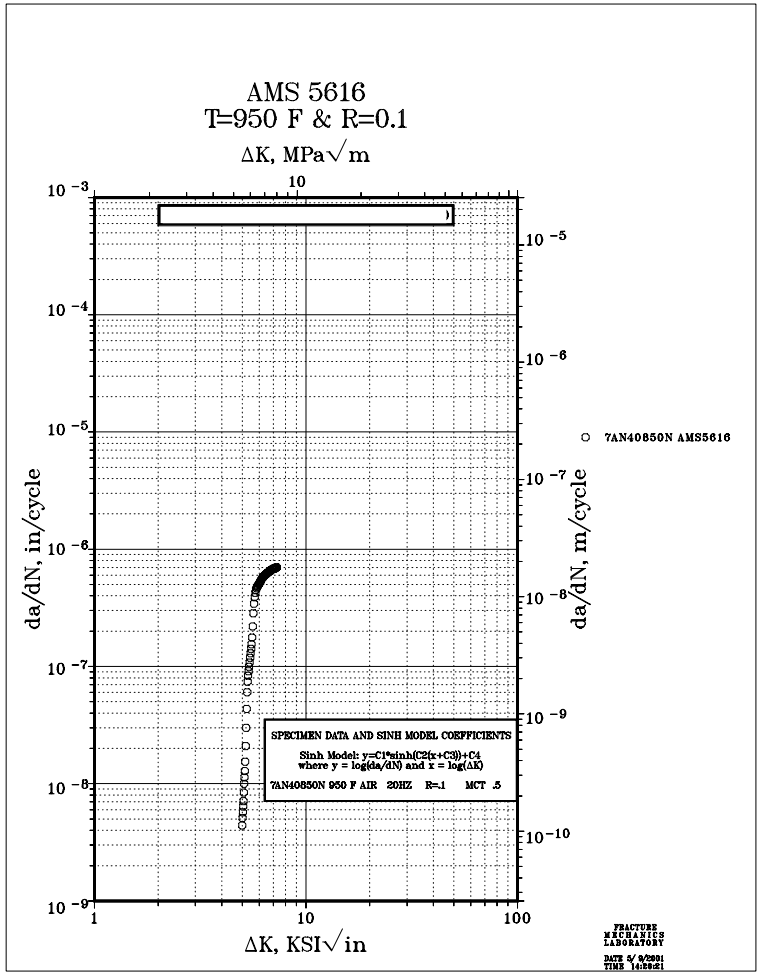

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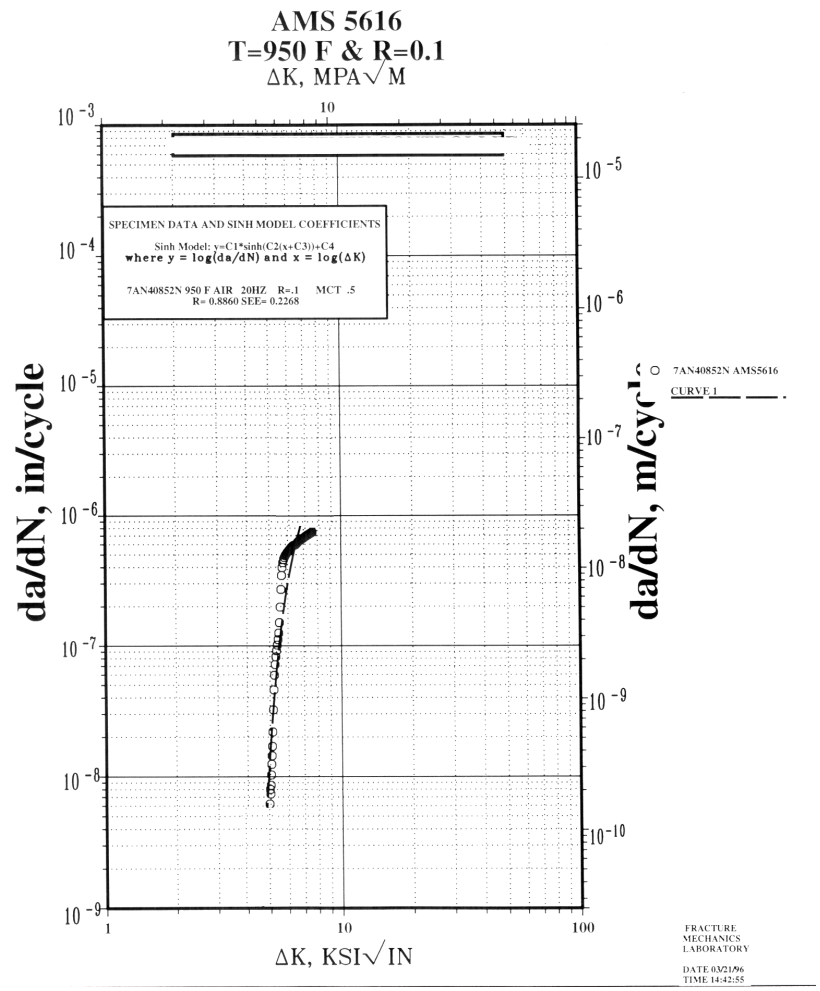

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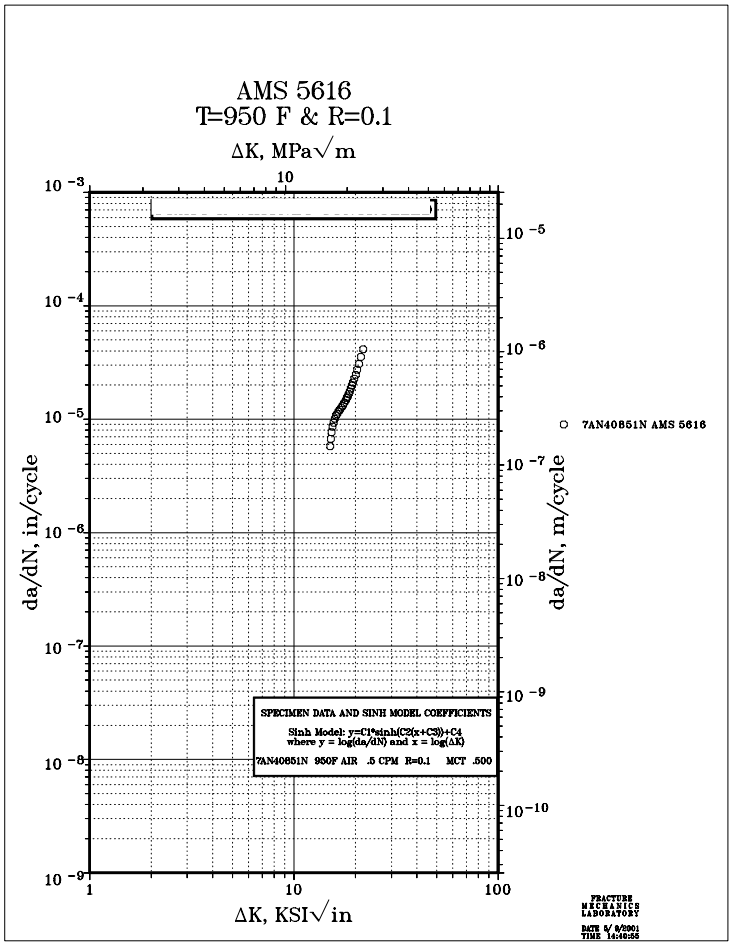

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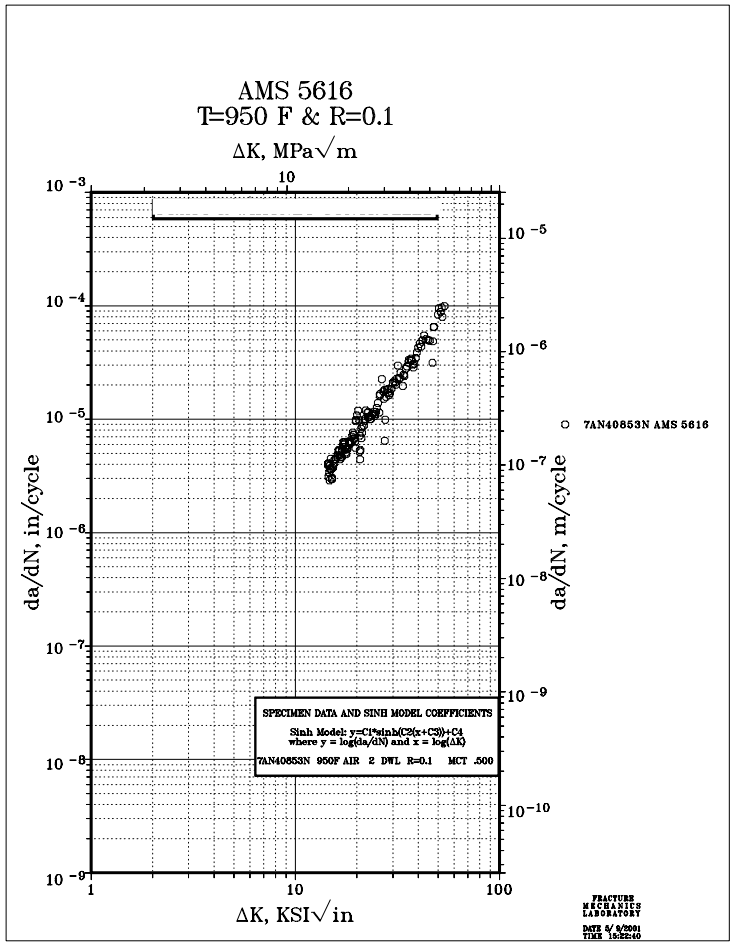

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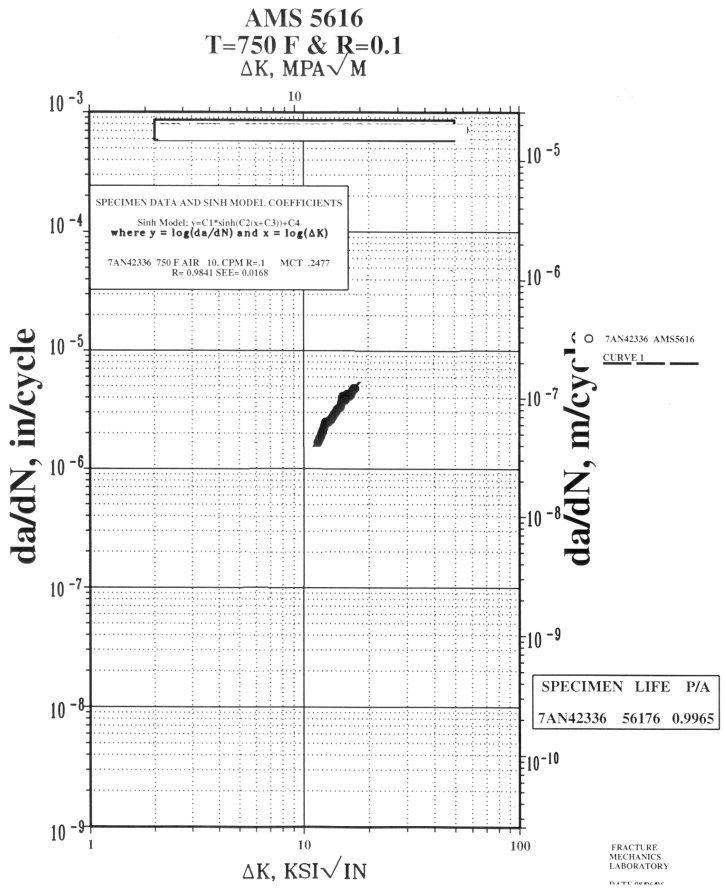

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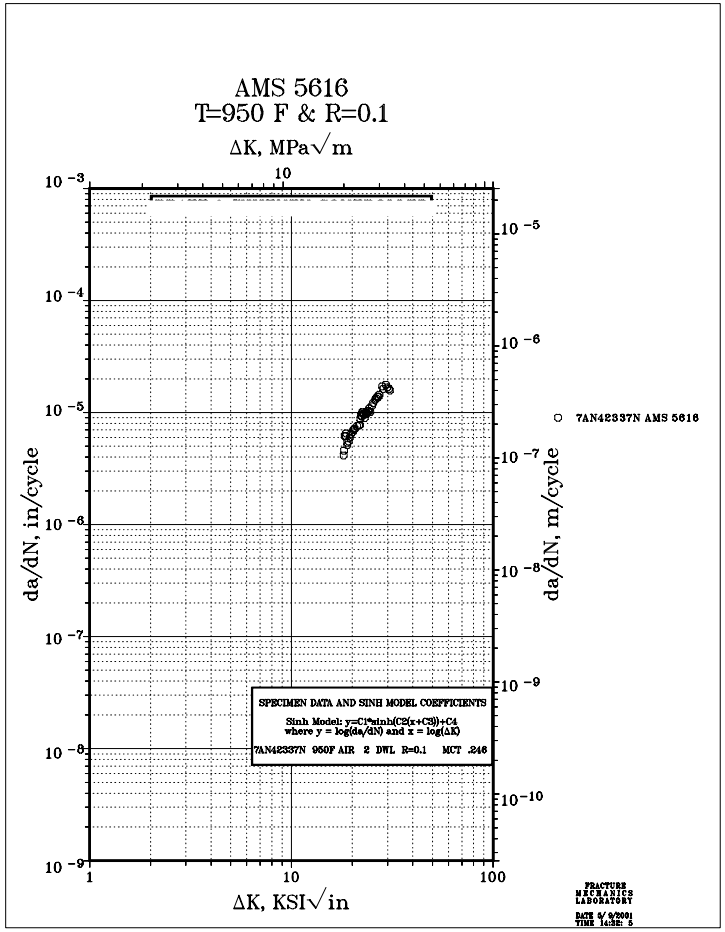

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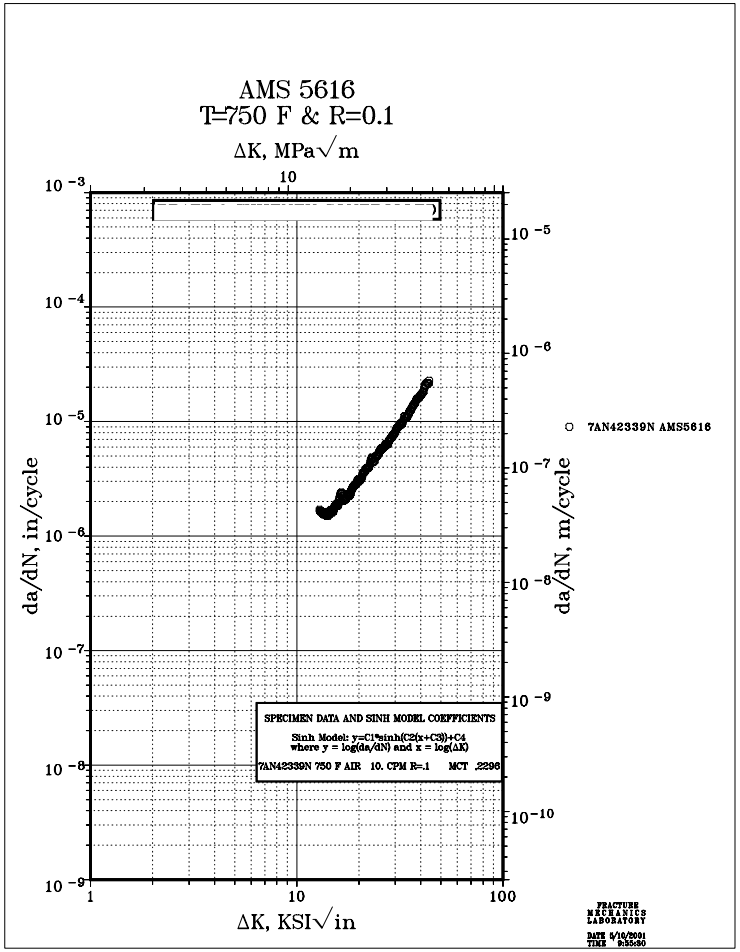

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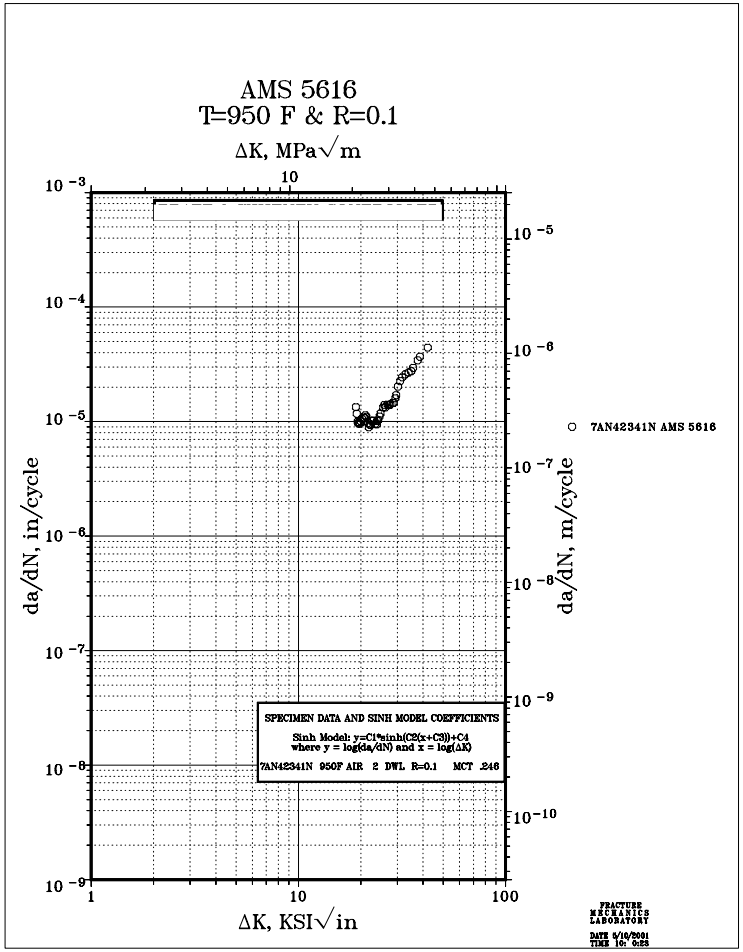

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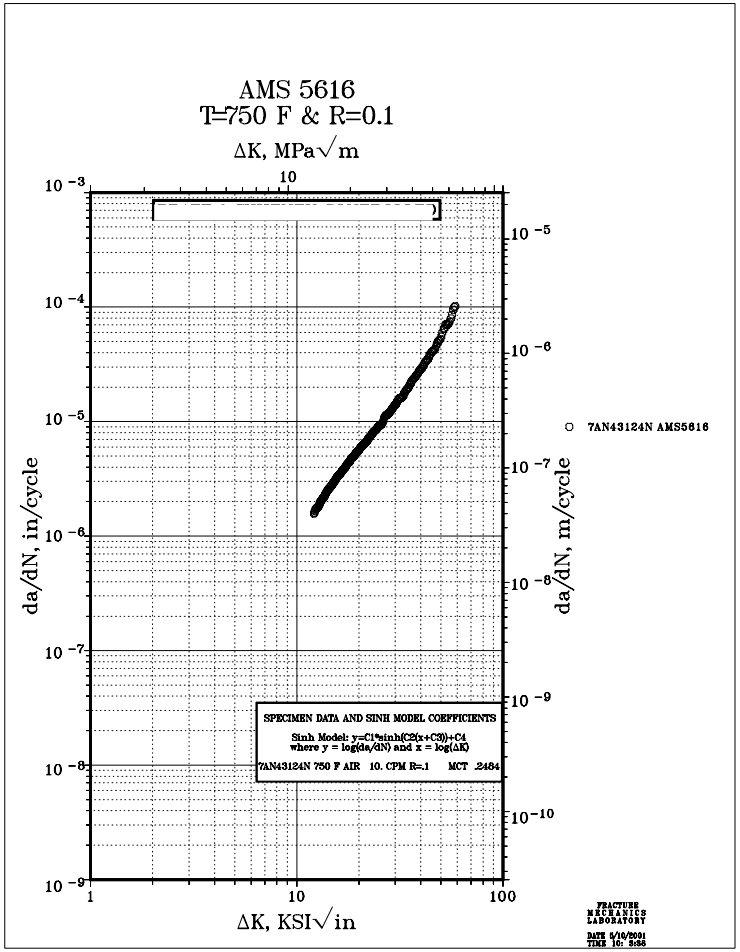

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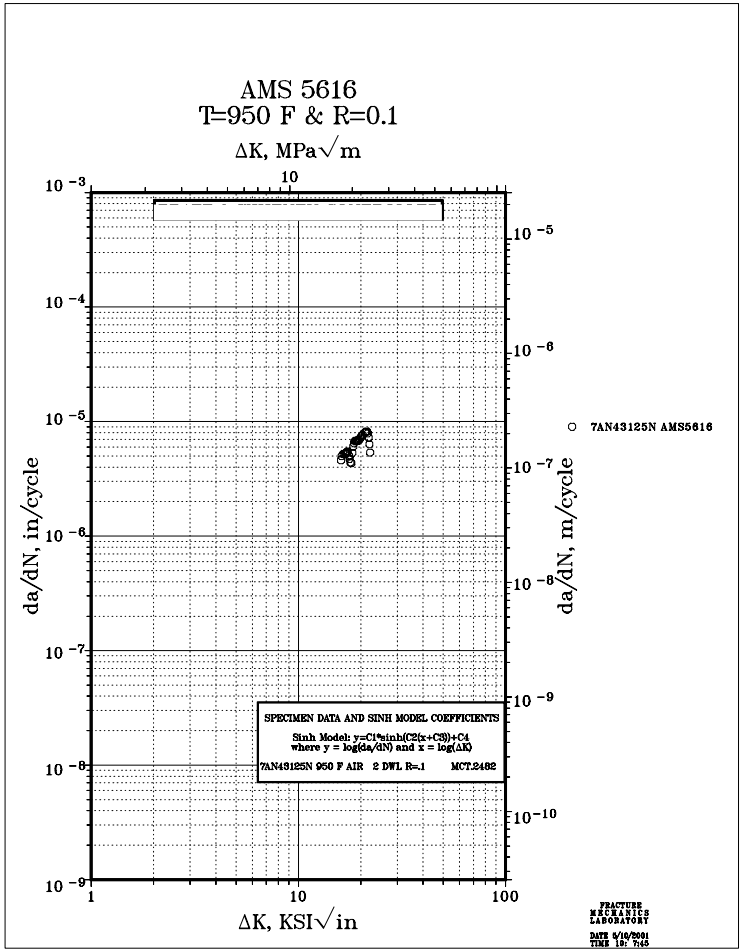

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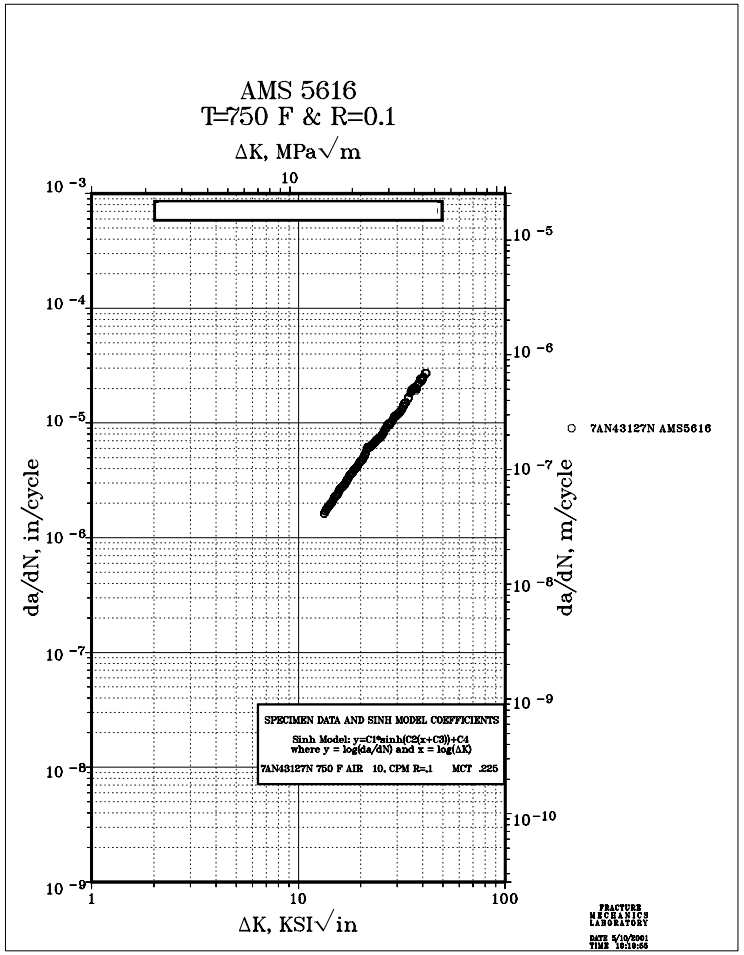

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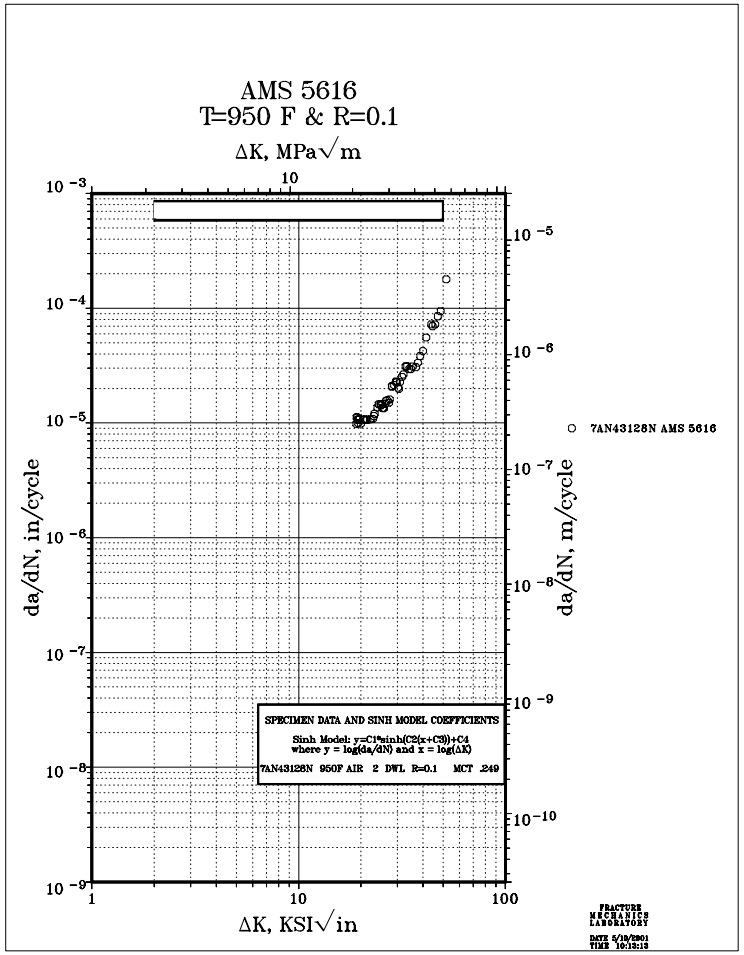

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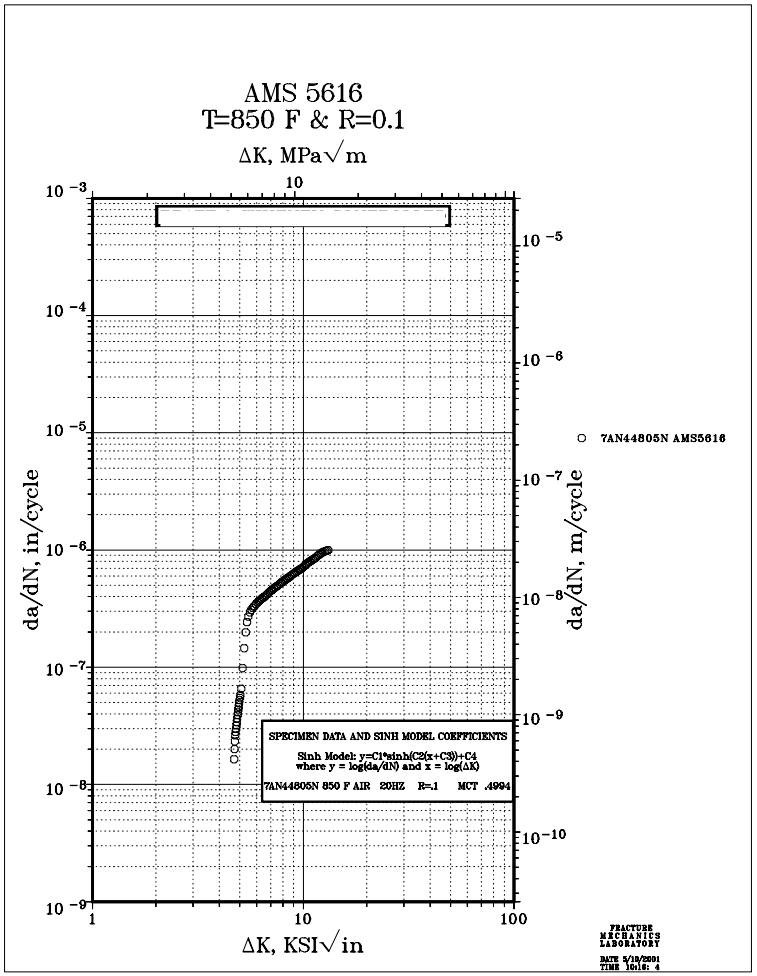

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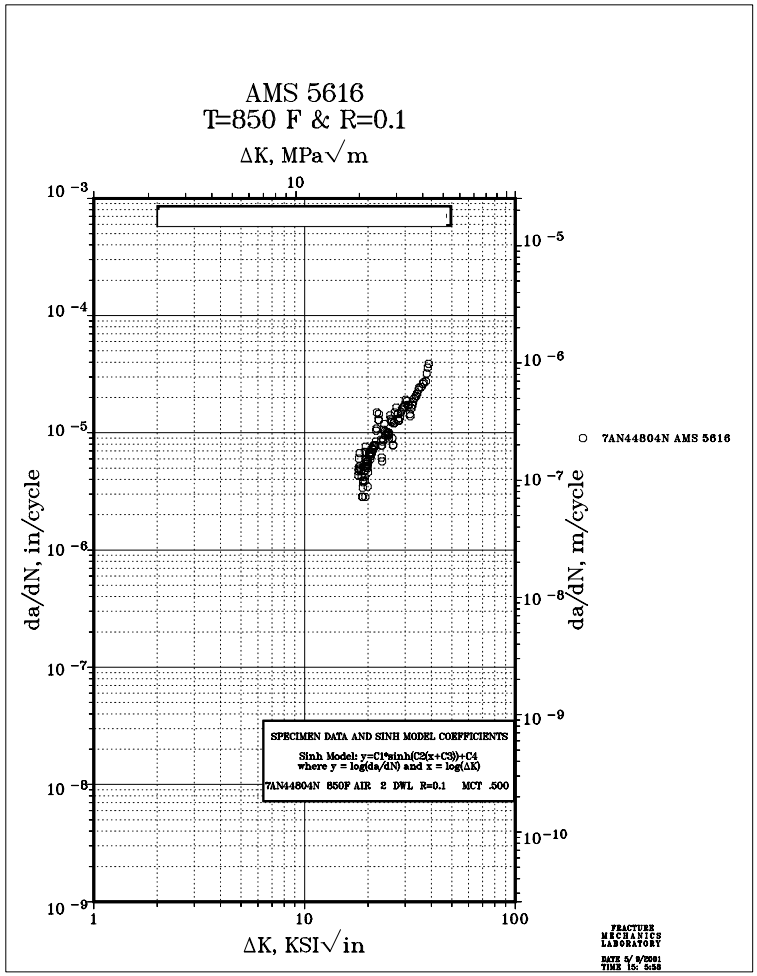


Chart A-47

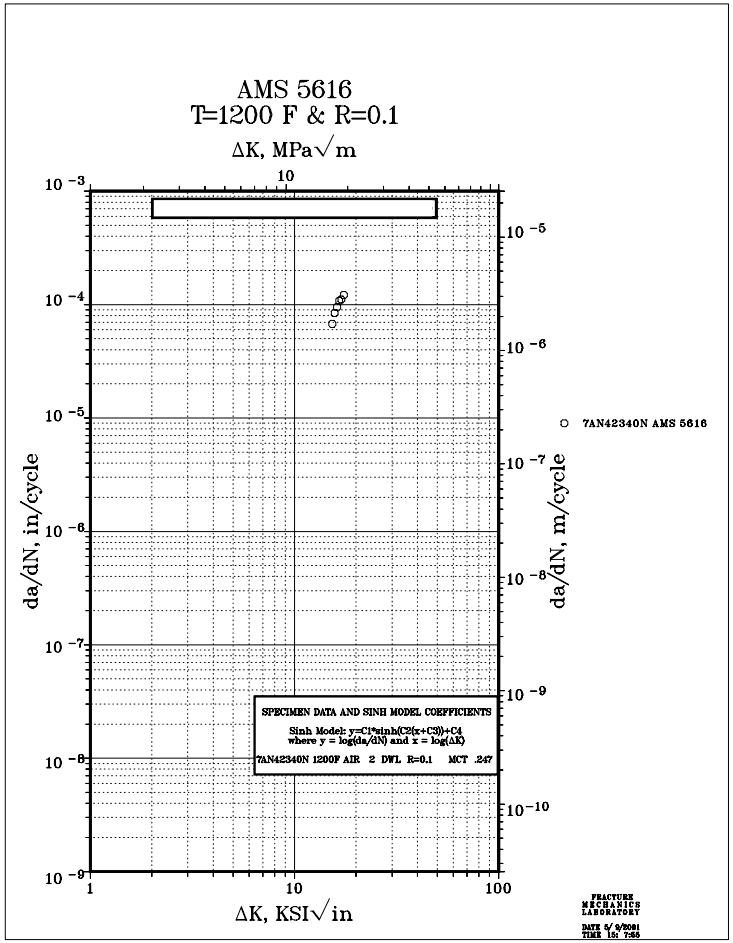

AMS 5616
T=1200 F & R=0.1
ΔK, MPa√m
10
da/dN, in/cycle
da/dN, m/cycle
7AN42340N AMS 5616
SPECIMEN DATA AND SINH MODEL COEFFICIENTS
Sinh Model: y=C1*sinh(C2(x+C3))+C4
where y = log(da/dN) and x = log(ΔK)
7AN42340N 1200F AIR 2 DWL R=0.1 MCT .247
ΔK, KSI√in
FRACTURE MECHANICS LABORATORY

Chart A-48

A.3 AMS 5663 da/dN PLOTS.

Chart No.	Material Source[1]	Condition[2]	Specimen Number	Test Temp.(°F)	Cyclic Rate	Comments
A-49	A	A	39810	800	10 cpm	Coarse Grain Baseline
A-50	A	A	41153	1100	10 cpm	Coarse Grain Baseline
A-51	A	A	39809	1100	2 mdw	Coarse Grain Baseline
A-52	A	A	41154	1200	10 cpm	Coarse Grain Baseline
A-53	A	A	41155	1200	2 mdw	Coarse Grain Baseline
A-54	A	A	41156[3]	1250	2 mdw	Coarse Grain Baseline
A-55	B	A	40371	800	10 cpm	Fine Grain Baseline
A-56	B	A	41161	1100	10 cpm	Fine Grain Baseline
A-57	B	A	40372	1100	2 mdw	Fine Grain Baseline
A-58	B	A	41162	1200	10 cpm	Fine Grain Baseline
A-59	B	A	41163	1200	2 mdw	Fine Grain Baseline
A-60	B	A	41164	1250	2 mdw	Fine Grain Baseline
A-61	A	B	40182	800	10 cpm	Effect of 6 Sol. Hours
A-62	A	B	40183	800	10 cpm	Effect of 6 Sol. Hours
A-63	A	B	40186	1100	2 mdw	Effect of 6 Sol. Hours
A-64	A	C	45840	1100	2 mdw	Effect of 30 Sol. Hours
A-65	B	C	45843	1100	2 mdw	Effect of 30 Sol. Hours
A-66	A	D	40184	800	10 cpm	Effect of 6 Short Ages
A-67	A	D	40185	800	10 cpm	Effect of 6 Short Ages
A-68	A	D	40188	1100	2 mdw	Effect of 6 Short Ages
A-69	A	D	40189	1100	2 mdw	Effect of 6 Short Ages
A-70	A	E	41755[5]	1000	2 mdw	Effect of long exposure
A-71	A	E	41754	1100	2 mdw	Effect of long exposure
A-72	B	F	42334	800	10 cpm	Weld FZ Baseline
A-73	B	F	42335	1100	2 mdw	Weld FZ Baseline
A-74	B	F	42549	800	10 cpm	Weld HAZ Baseline
A-75	B	F	42550[6]	1100	2 mdw	Weld HAZ Baseline
A-76	B	G	42812	800	10 cpm	Effect of 30 Sol. Hours on FZ
A-77	B	G	42814	1100	2 mdw	Effect of 30 Sol. Hours on FZ
A-78	B	G	42815	1100	2 mdw	Effect of 30 Sol. Hours on FZ
A-79	B	G	42816	800	10 cpm	Effect of 30 Sol. Hours on HAZ
A-80	B	G	42818	1100	2 mdw	Effect of 30 Sol. Hours on HAZ
A-81	B	G	42819	1100	2 mdw	Effect of 30 Sol. Hours on HAZ

Notes: 1. A: PW4000 HPT Case Heat CKLBCD B: Barstock: PHDMG
2. A FHT: Solution + Age B: FHT + 6 X (1 Hr. Sol. + Age)
C: FHT + 6 X (5 hrs. Sol. + Age) D: FHT + 6 X Short Age Cycle
E: FHT + 1100F (1,000 hrs.) F: Sol. + Weld + FHT
G: Sol. + Weld + FHT + 6X(5 hrs. Sol. + Age)
3. Test rig problem; No data generated.
4. Invalid test progression; Data not usable.
5. Electronic data file lost.
6. Crack initiated in HAZ; progressed primarily in FZ.

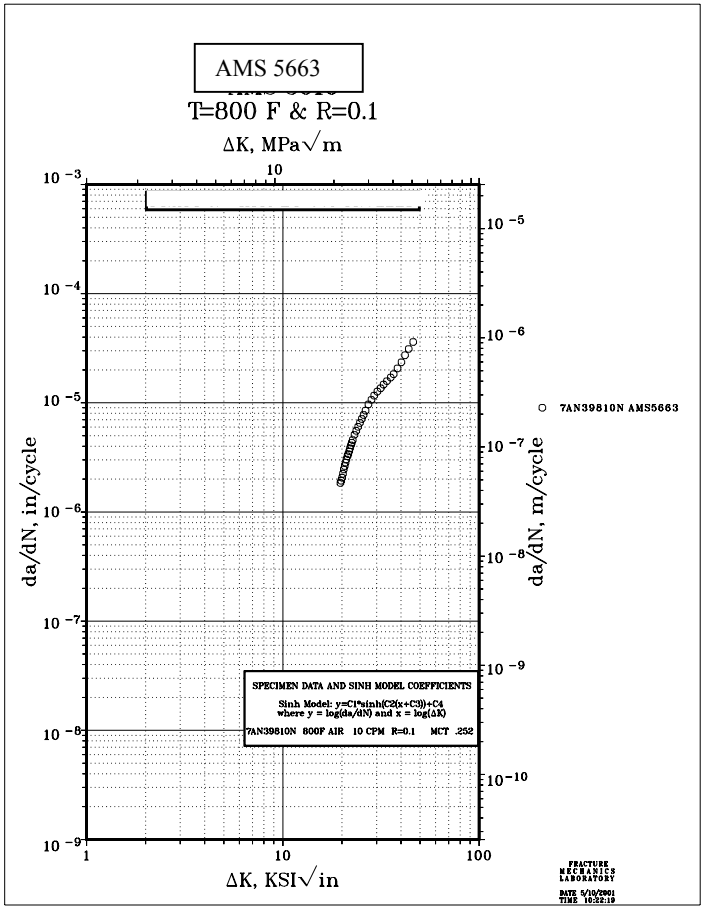
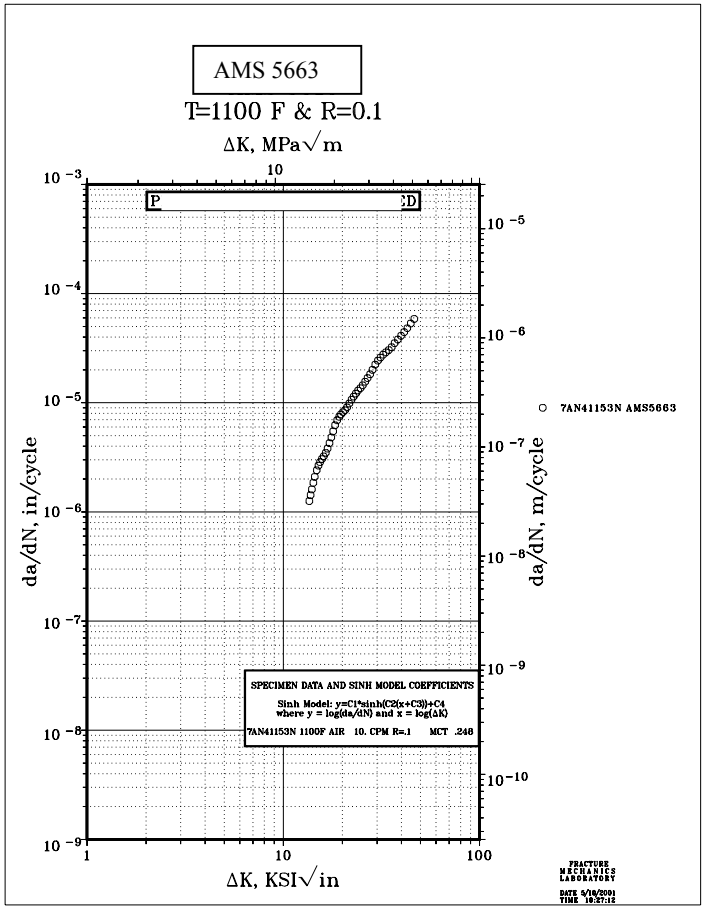


Chart A-49



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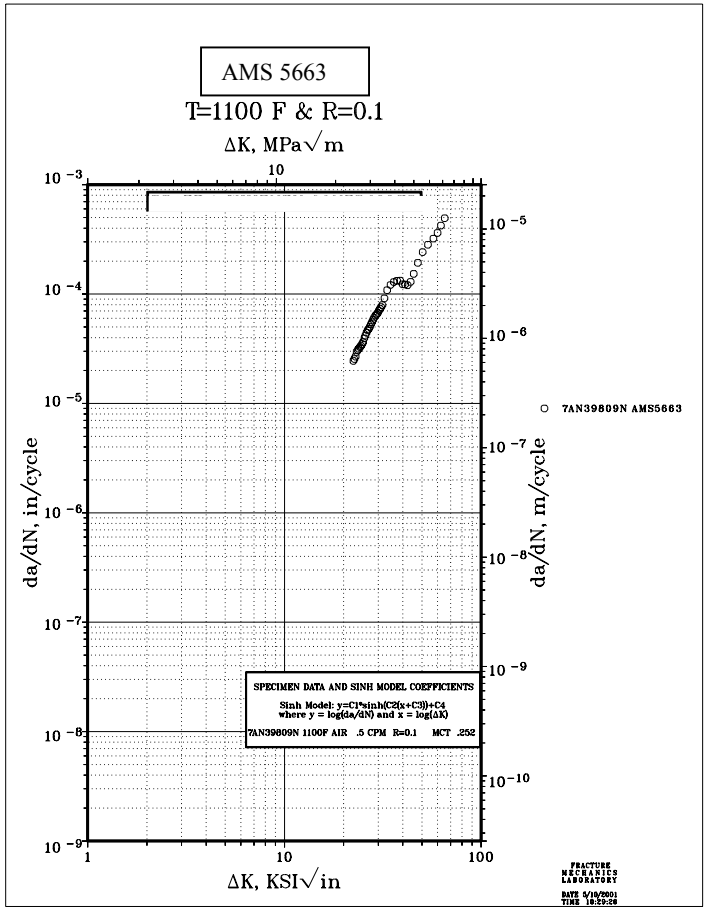

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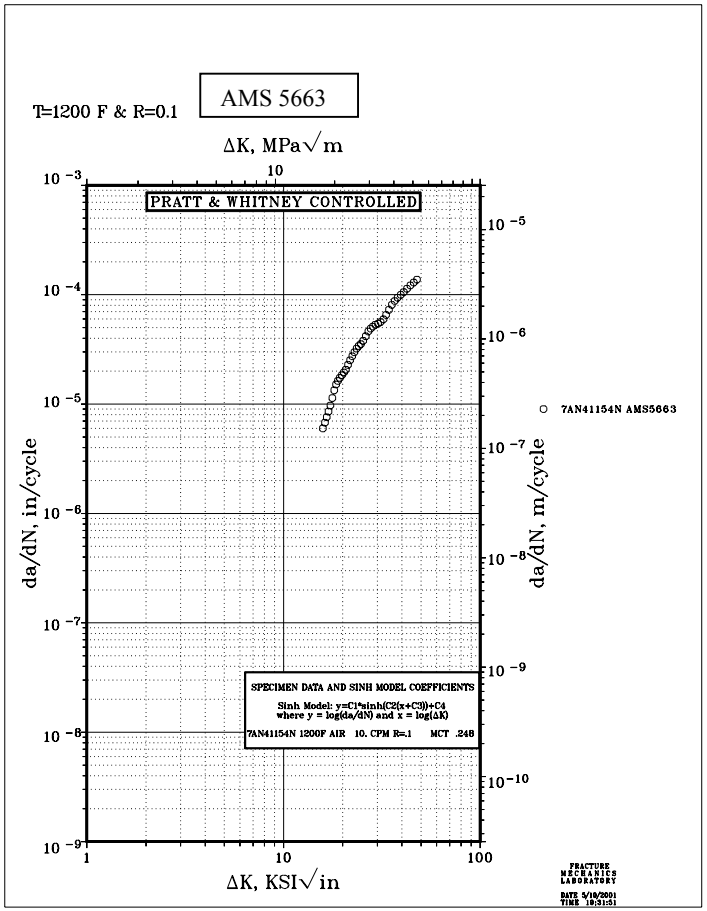

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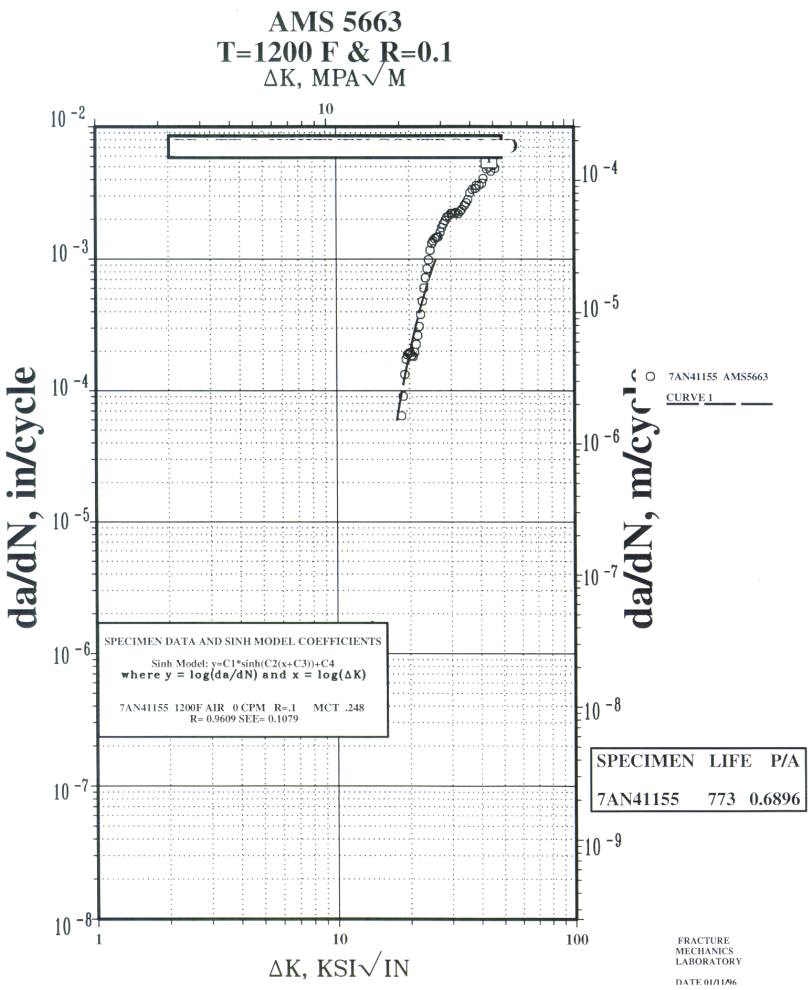

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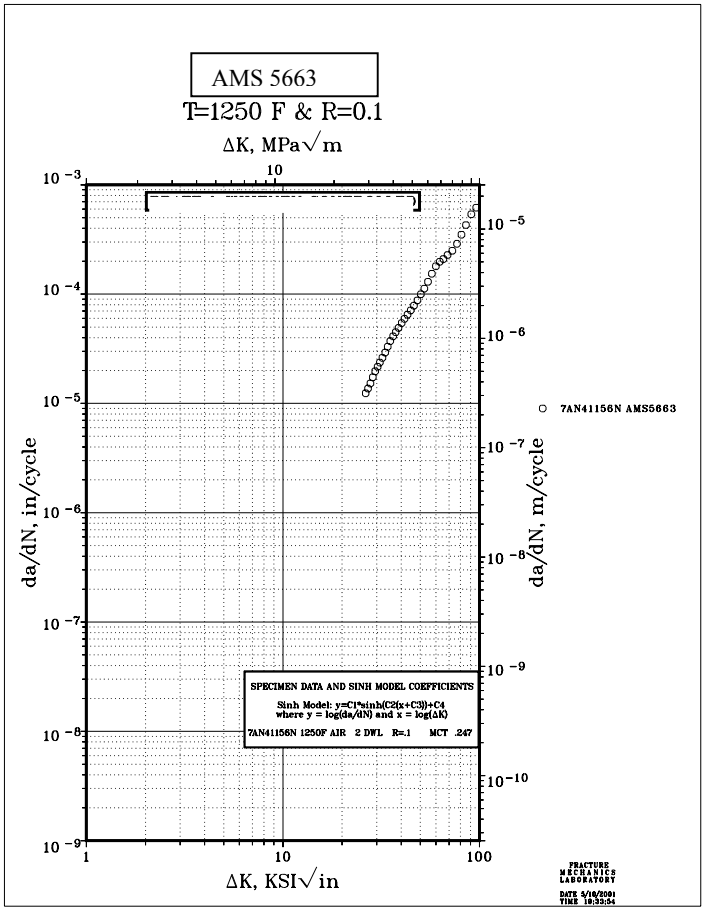

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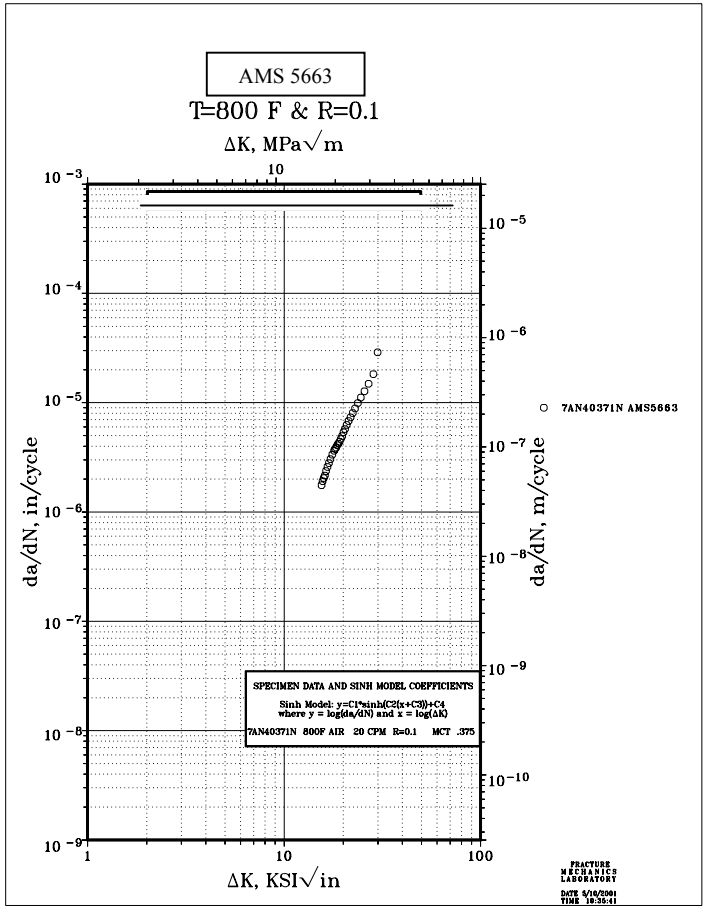

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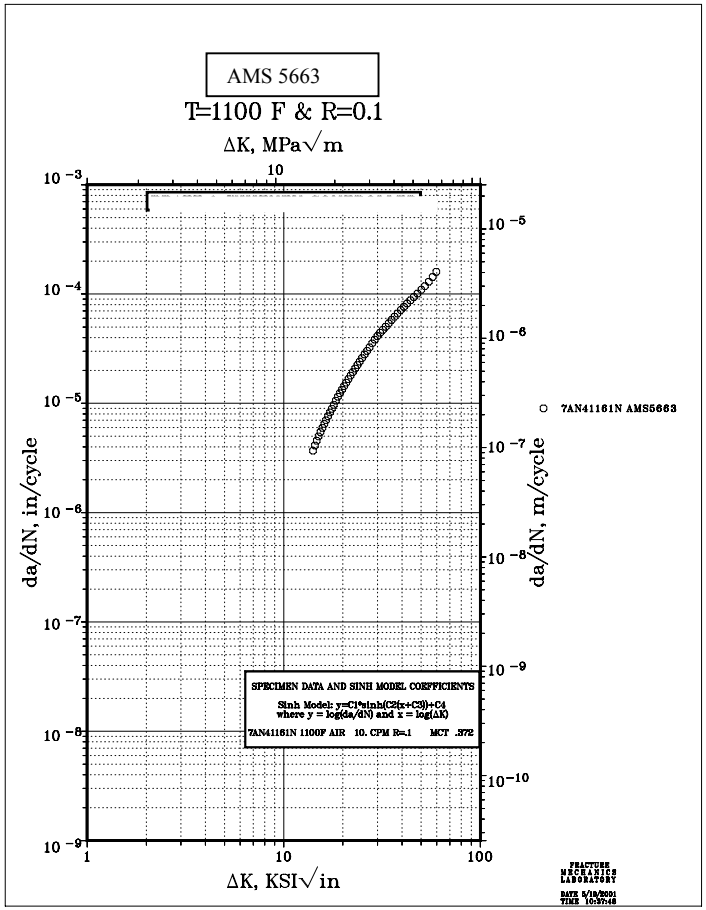

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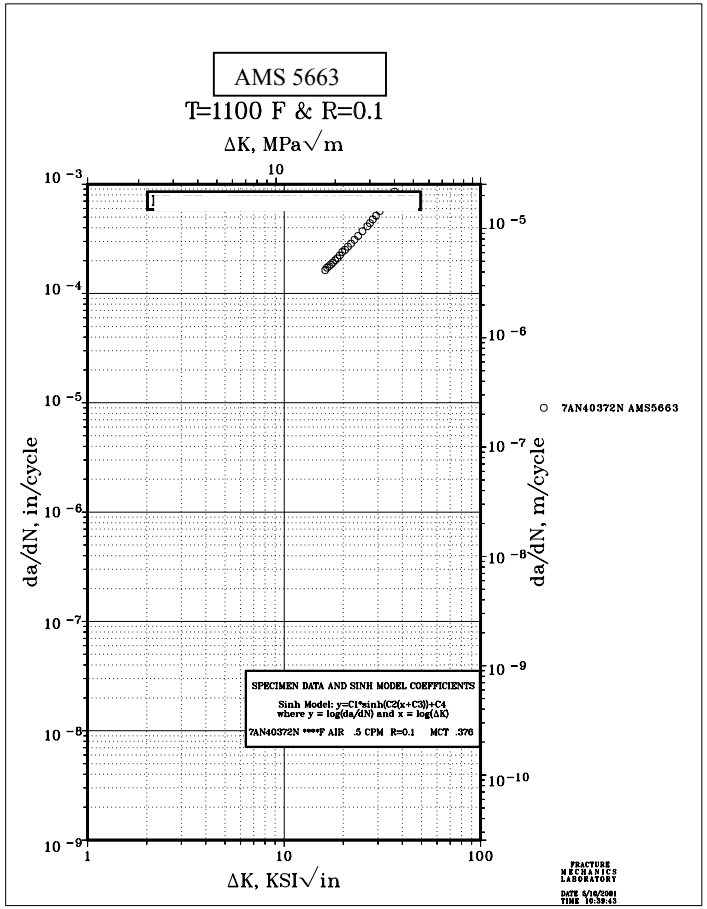

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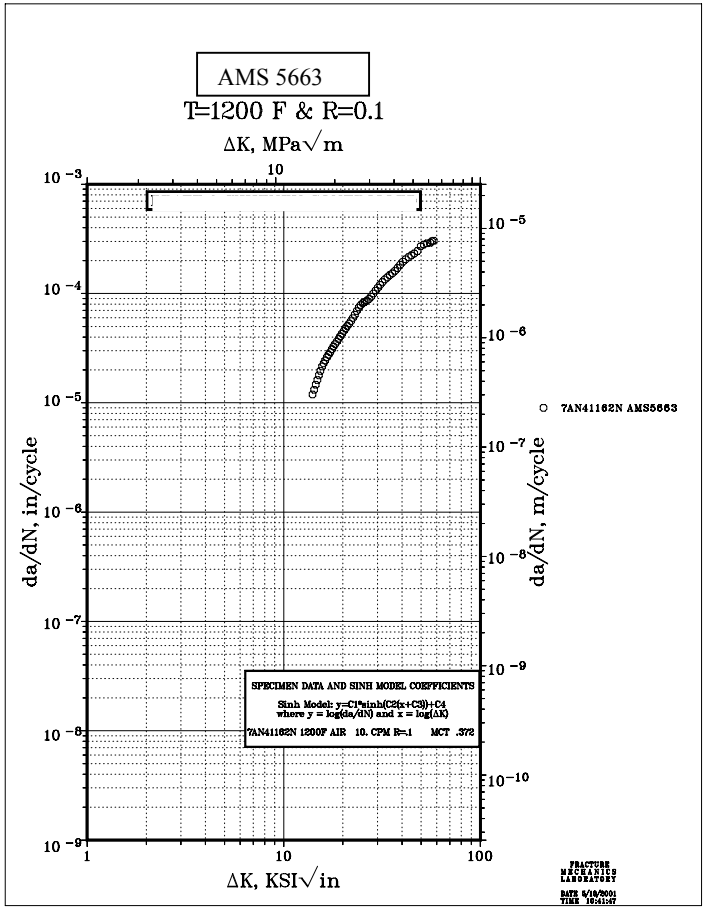

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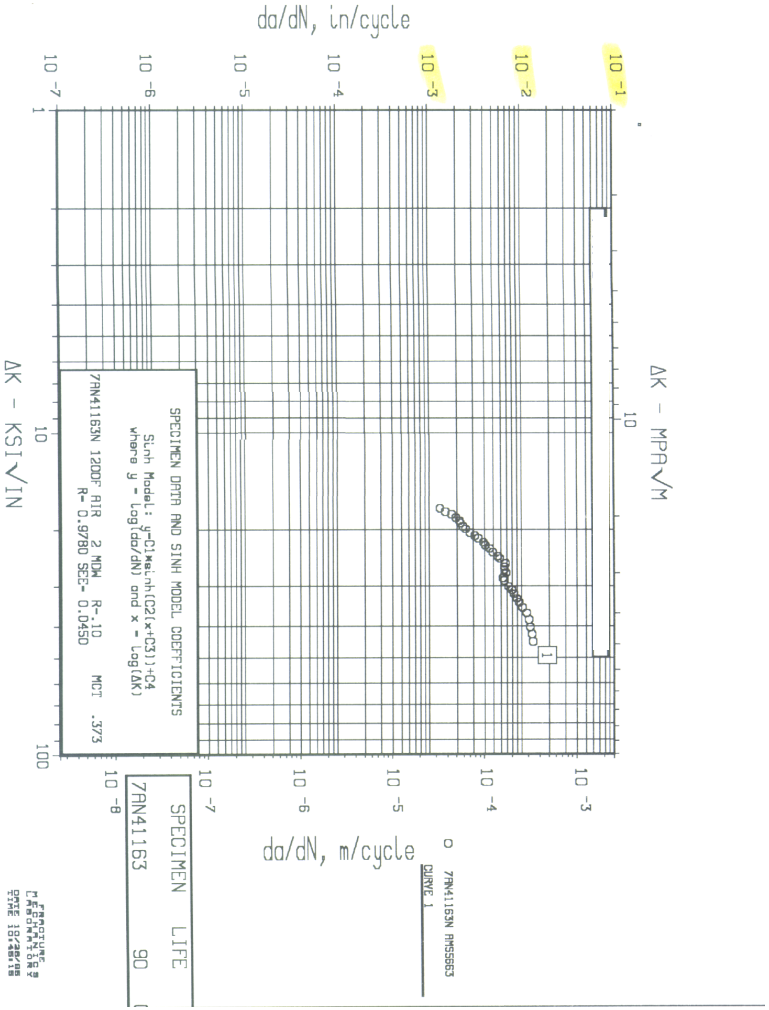

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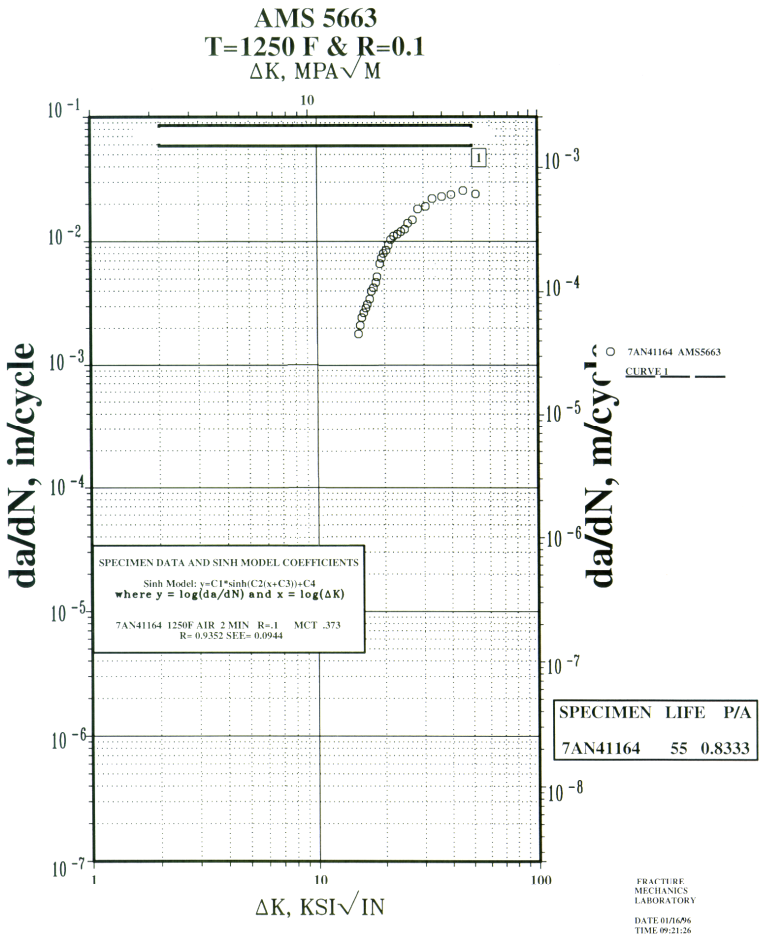

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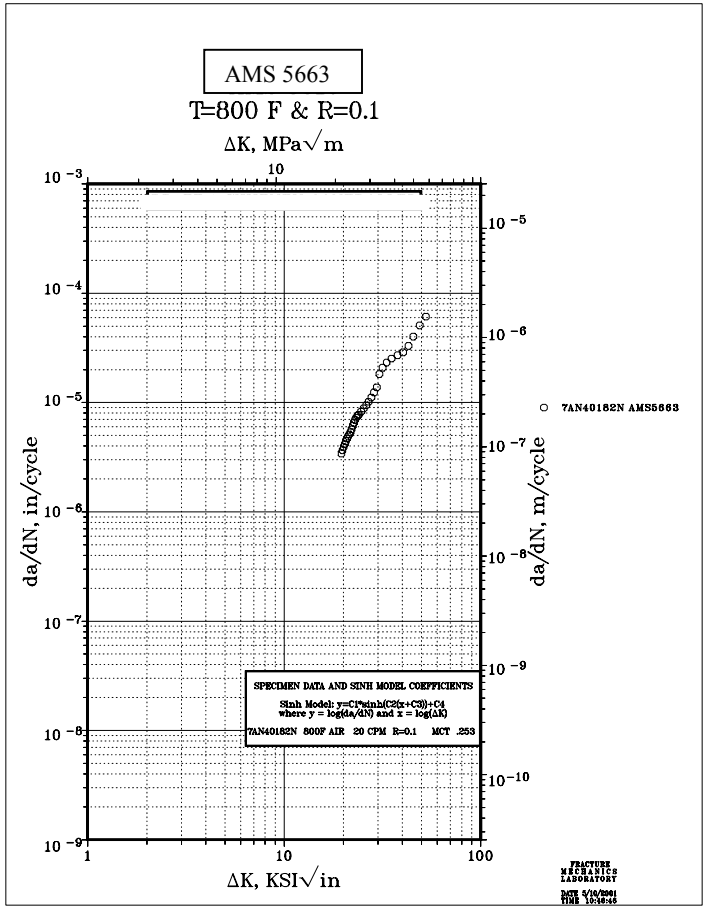

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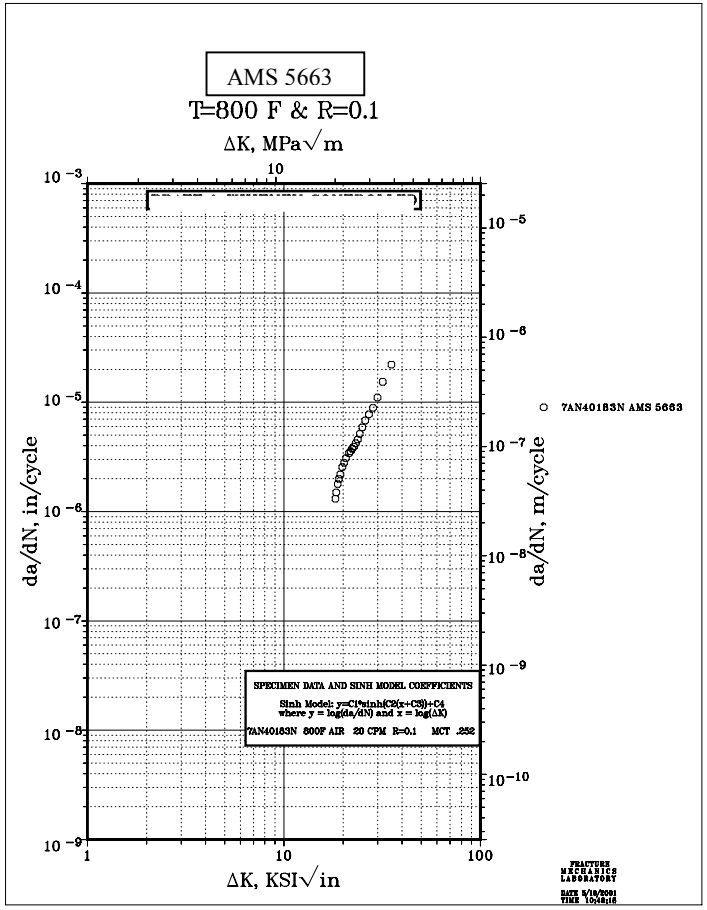

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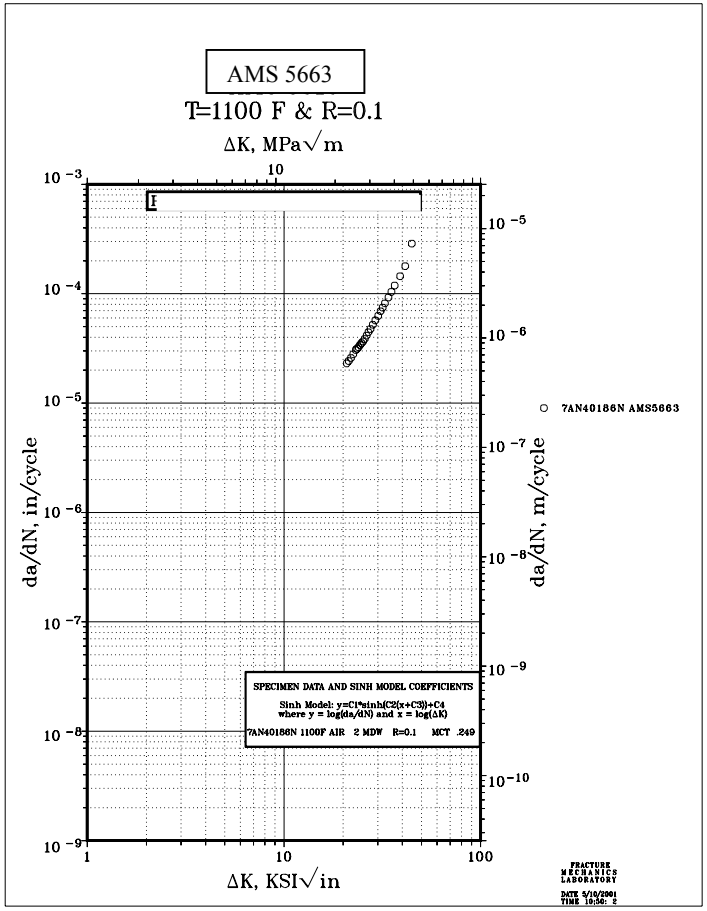

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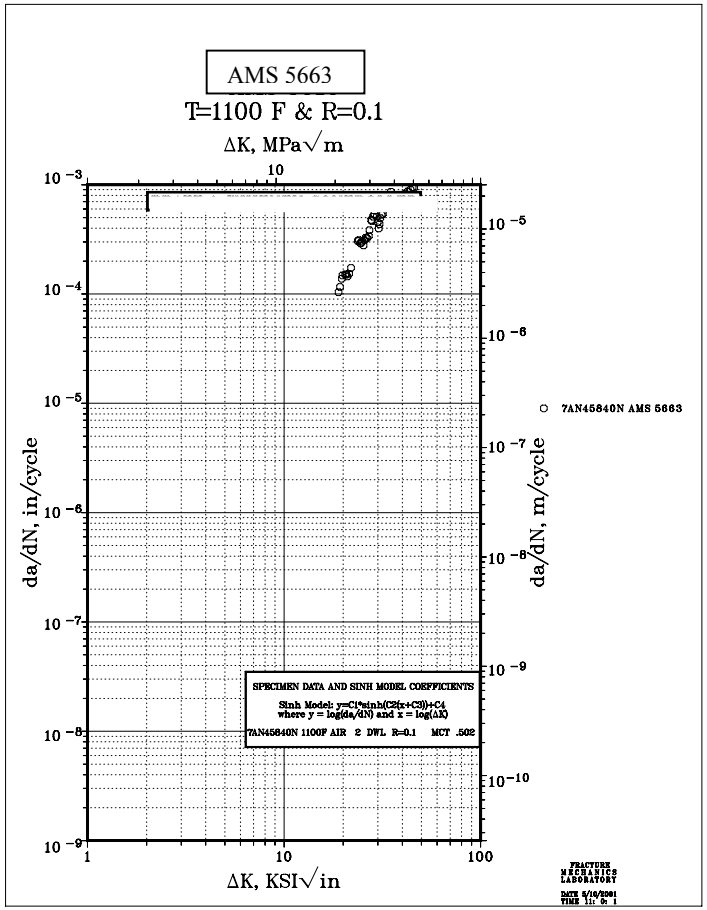

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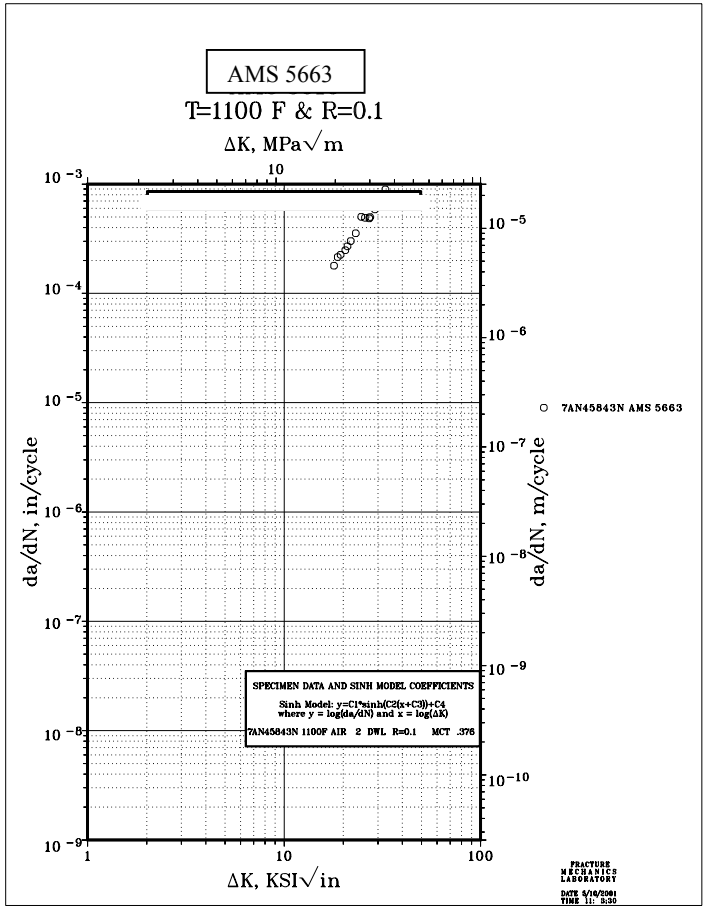

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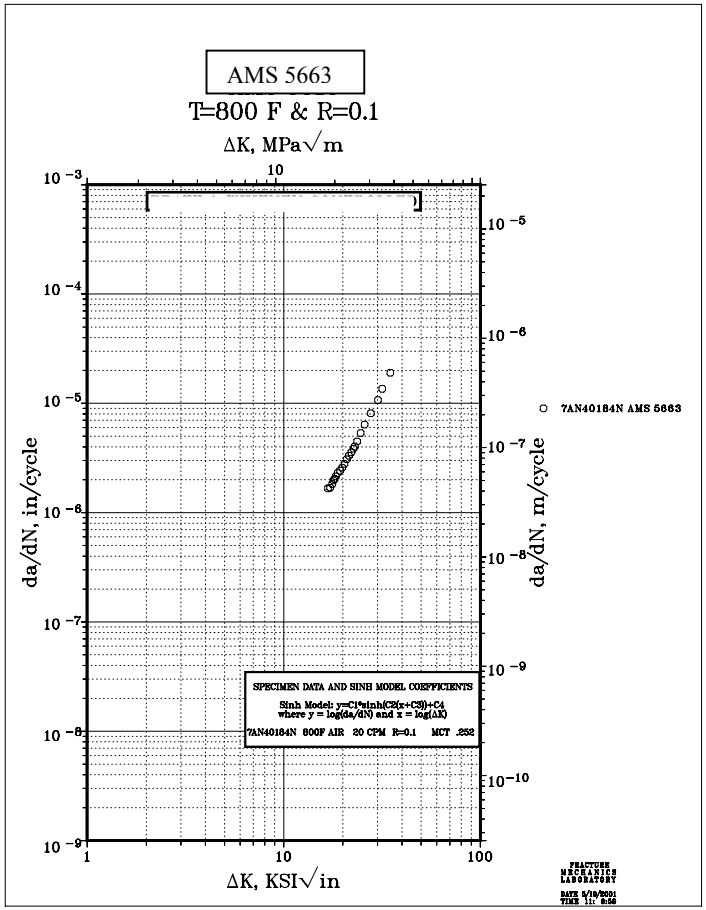

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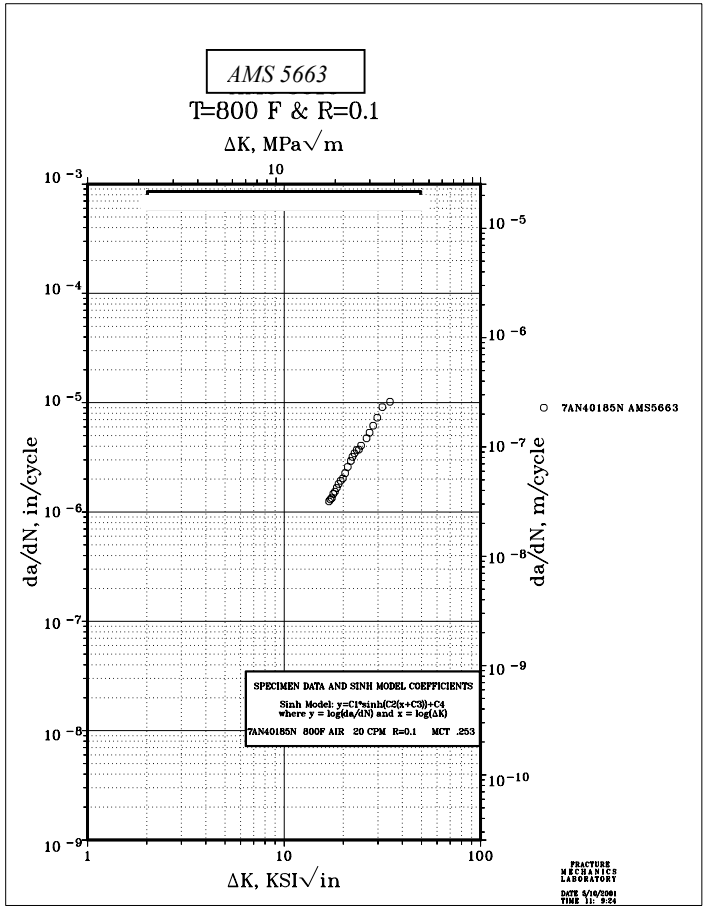

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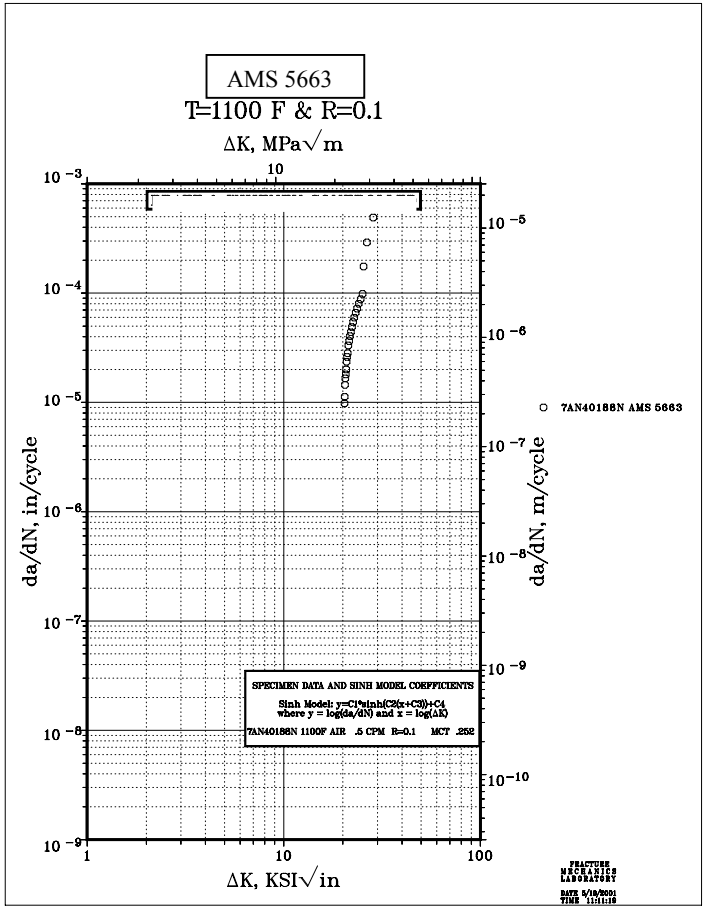

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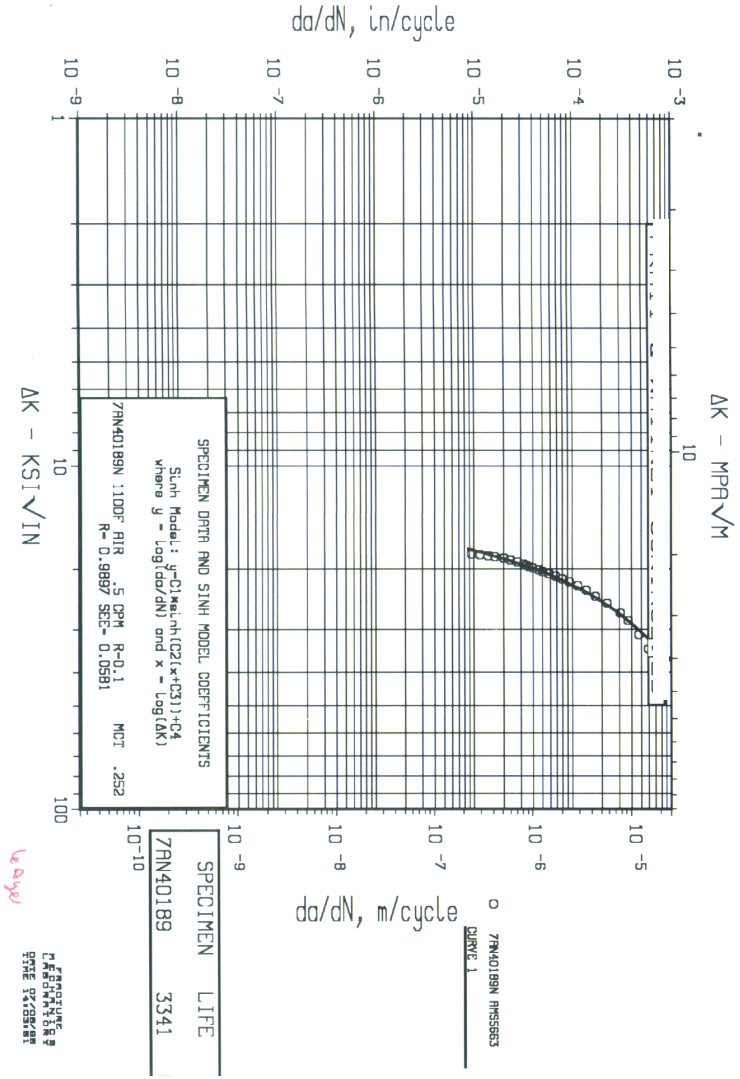

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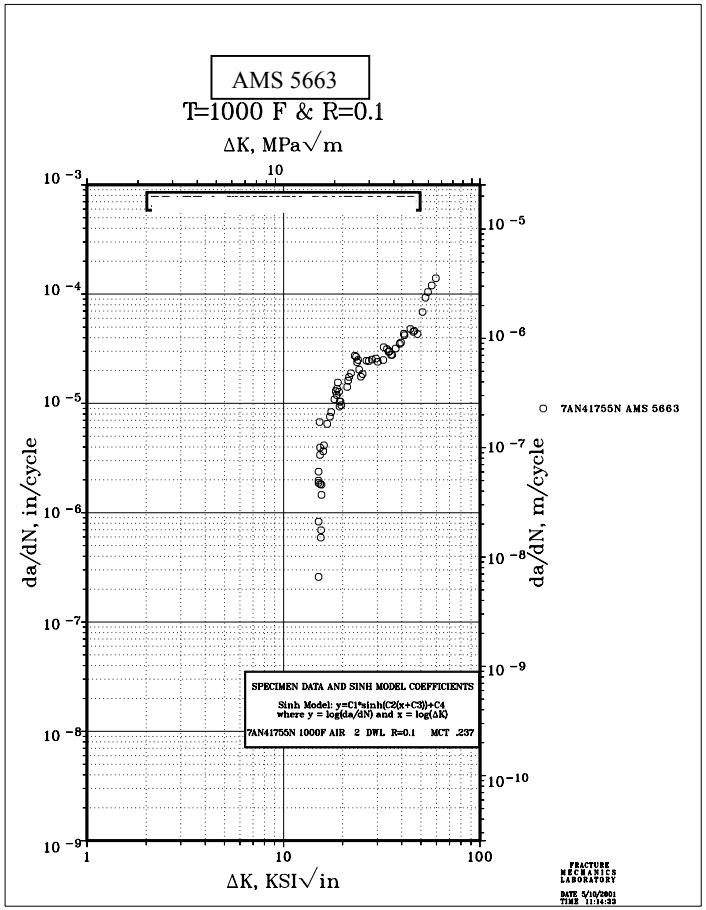

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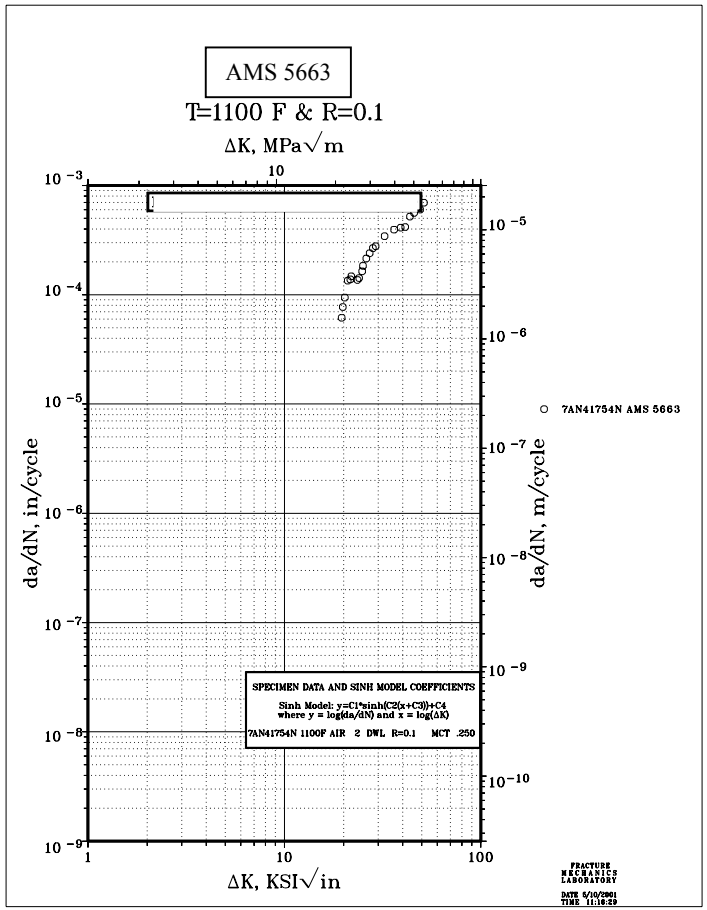

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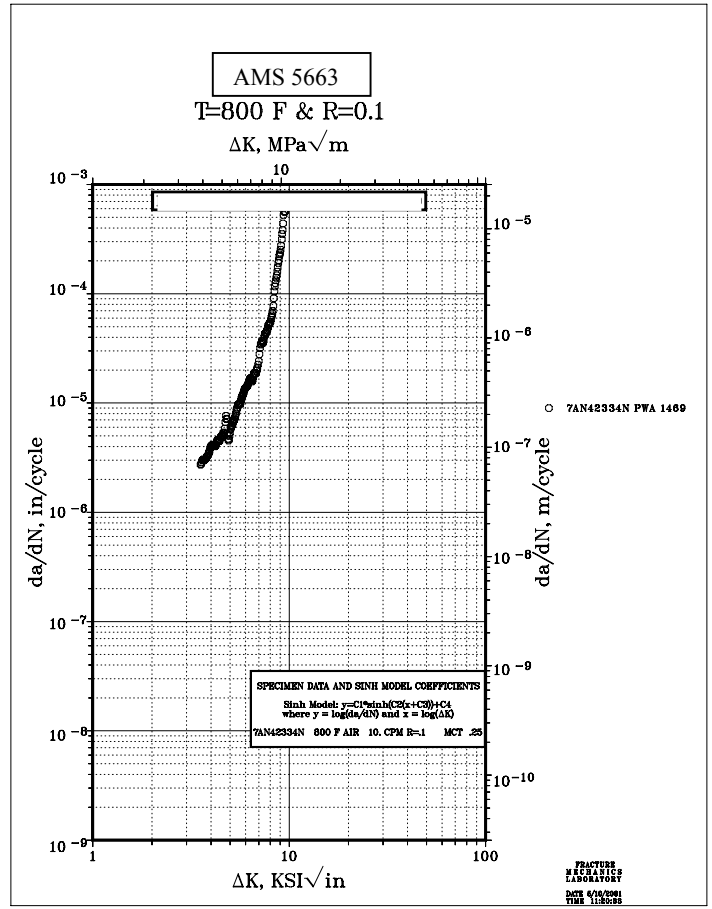

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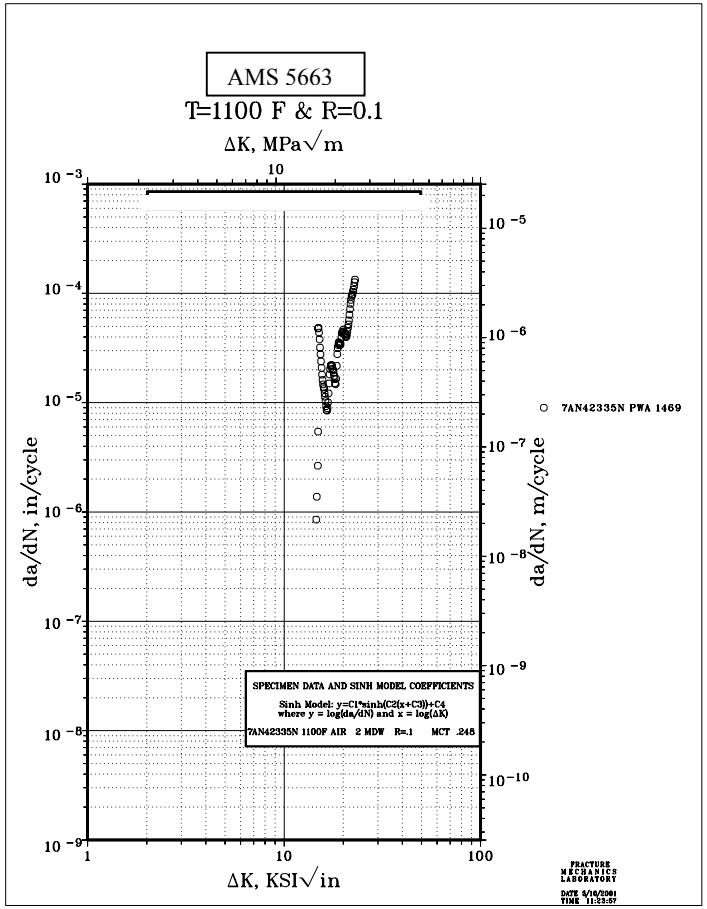

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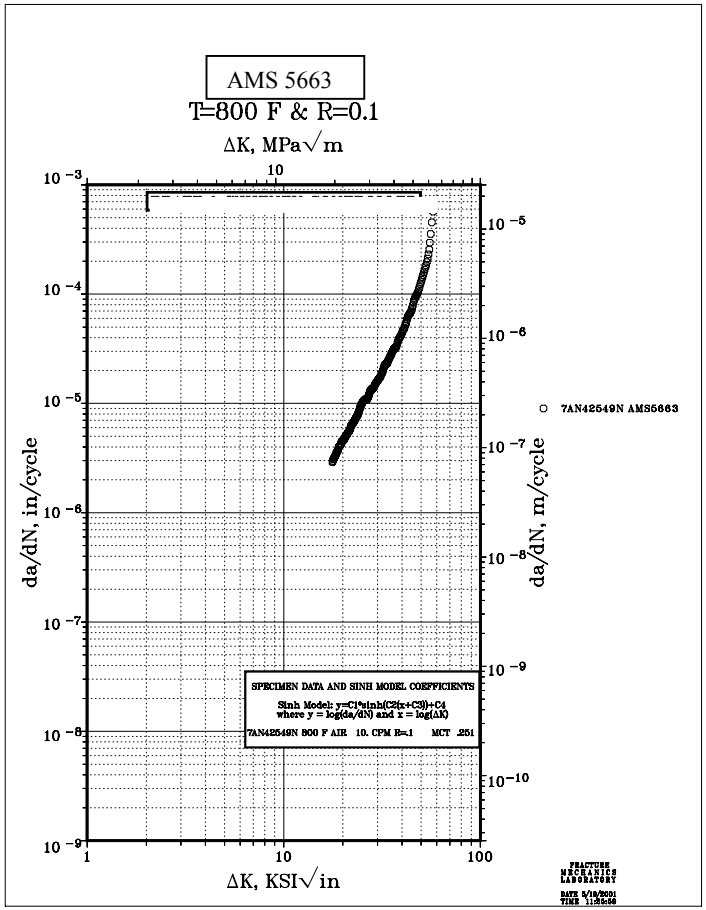

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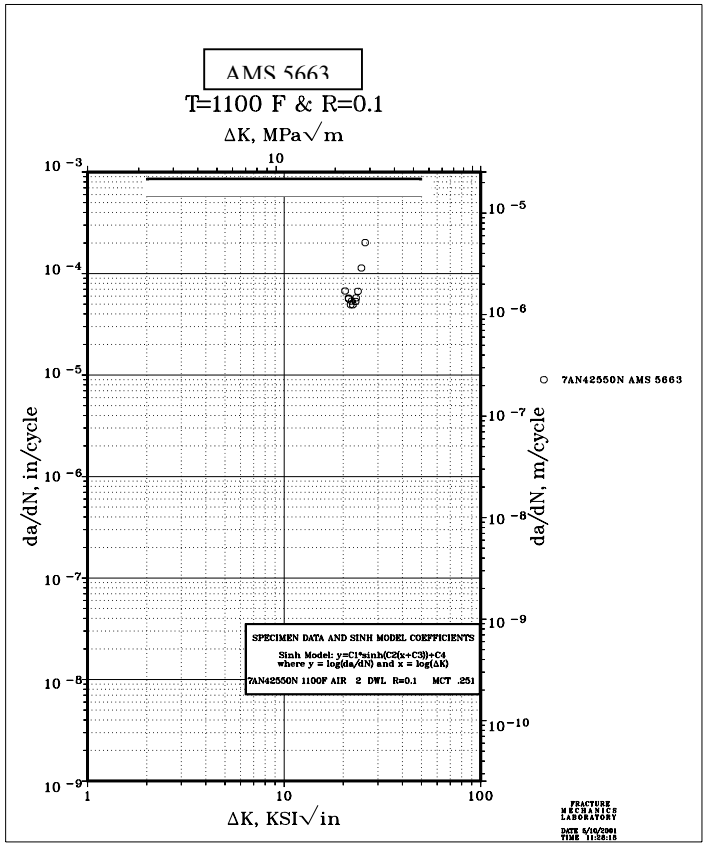

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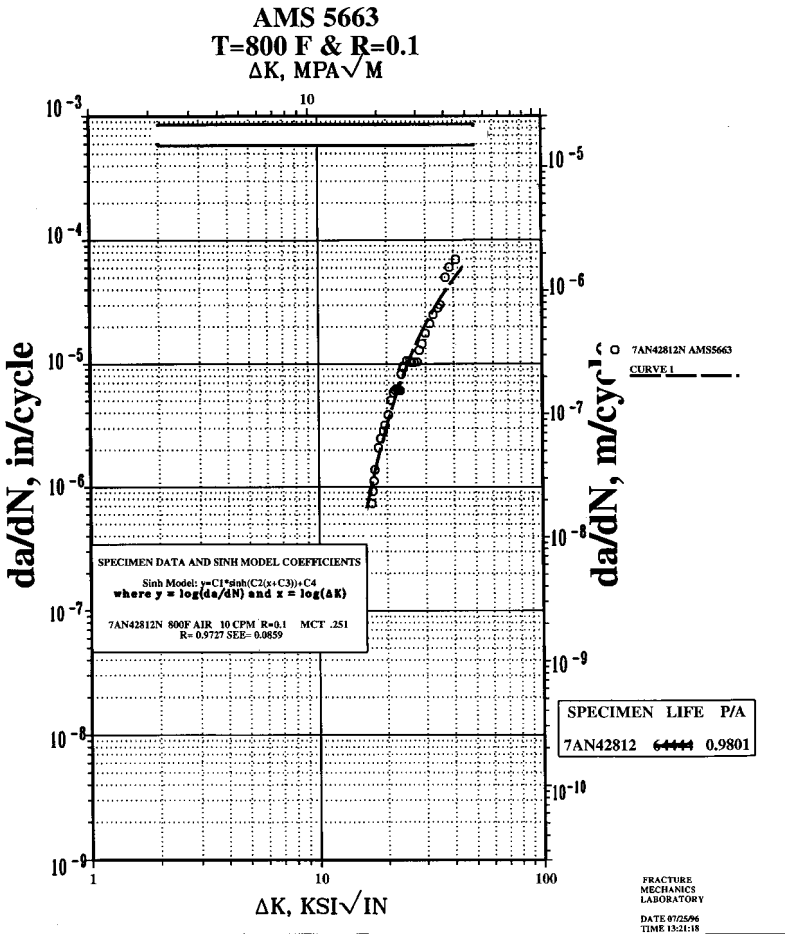

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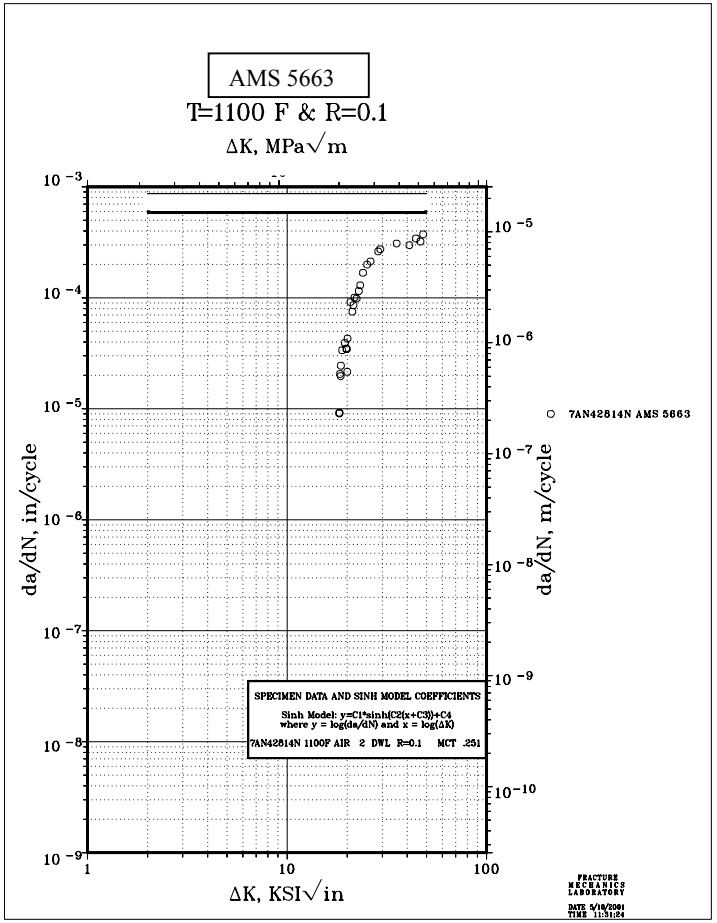

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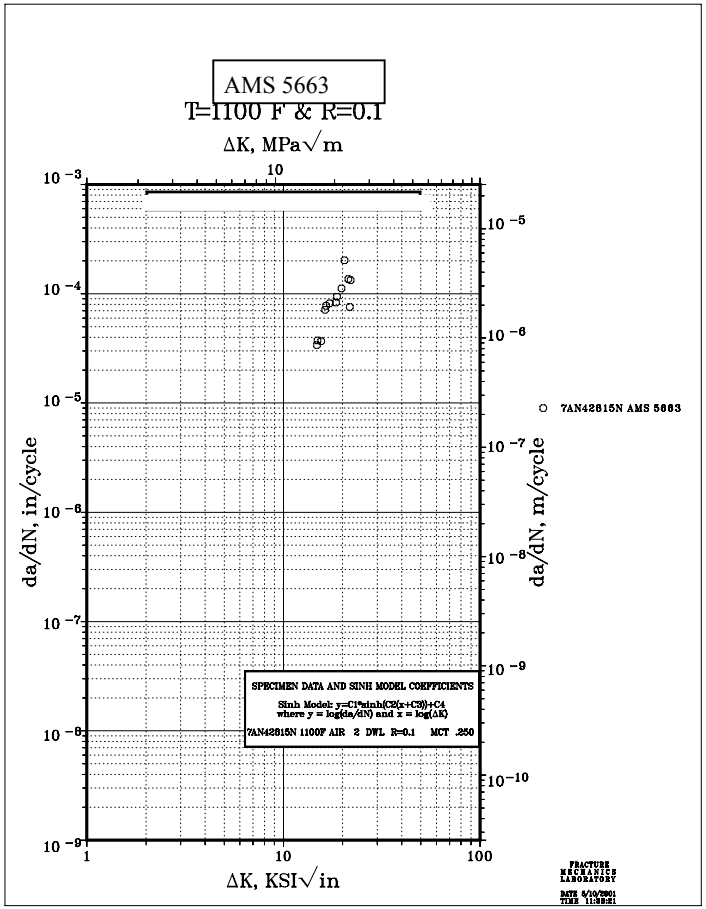

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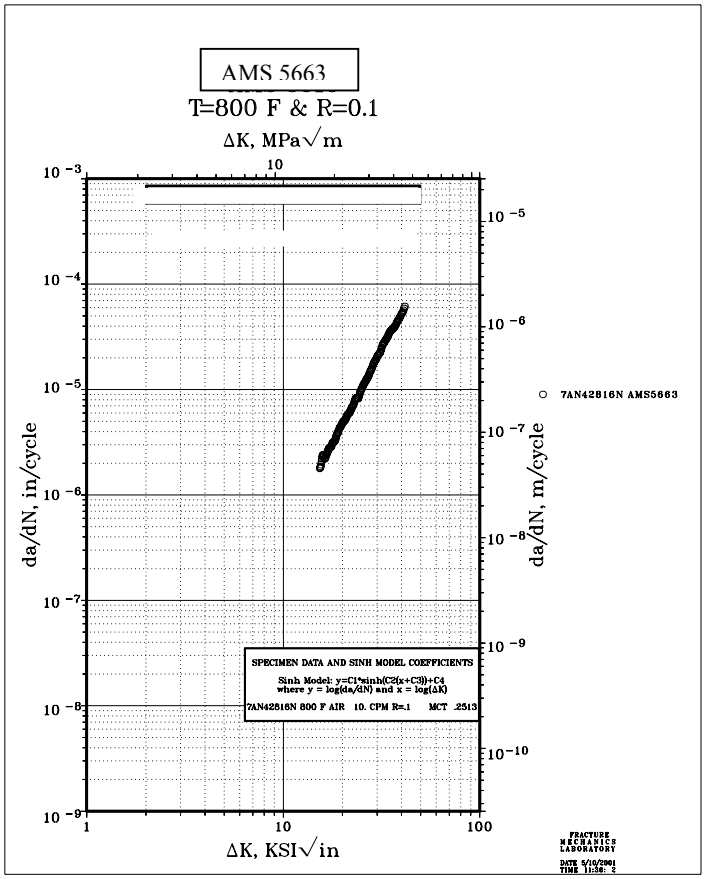

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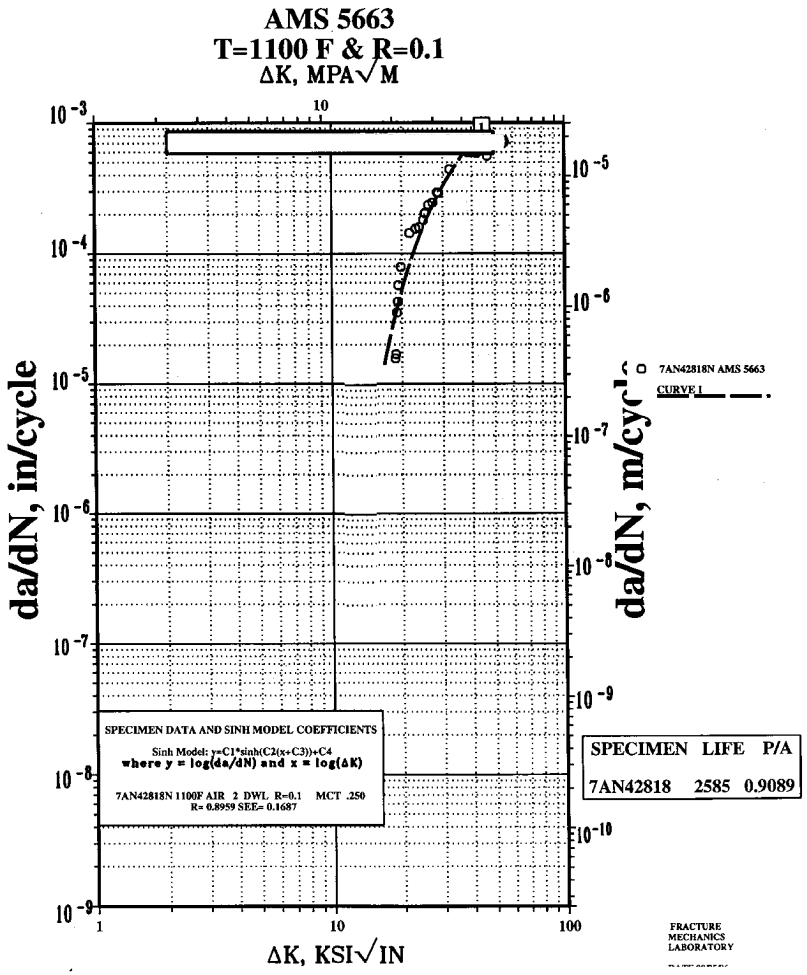

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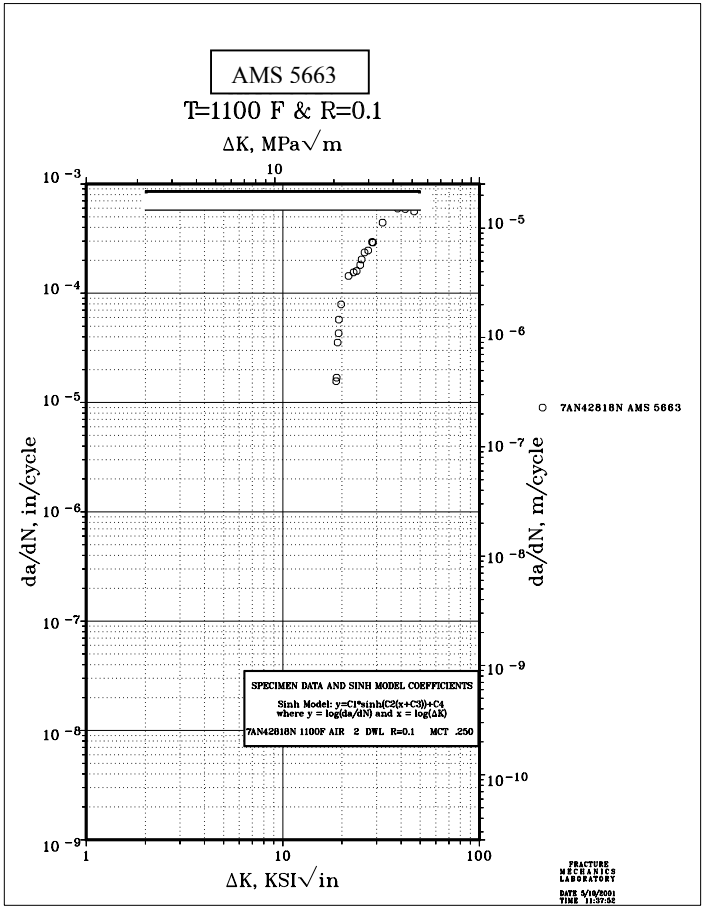

AMS 5663
T=1100 F & R=0.1
ΔK, MPa√m
10
da/dN, in/cycle
da/dN, m/cycle
7AN42818N AMS 5663
SPECIMEN DATA AND SINH MODEL COEFFICIENTS
Sinh Model: y=C1*sinh(C2(x+C3))+C4
where y = log(da/dN) and x = log(ΔK)
7AN42818N 1100F AIR 2 DWL R=0.1 MCT .250
ΔK, KSI√in
FRACTURE MECHANICS LABORATORY

Chart A-81

A.4. PWA 1469 da/dN PLOTS.

Chart No.	Material Source[1]	Condition[2]	Specimen Number	Test Temp.(°F)	Cyclic Rate	Comments
A-82	A	A	44615	1100	2 mdw	Baseline
A-83	A	A	44616	1100	2 mdw	Baseline
A-84	A	B	9029	1100	10 cpm	Effect of 40 hrs. solution
A-85	A	B	9030	1100	10 cpm	Effect of 40 hrs. solution
A-86	A	B	46230	1100	2 mdw	Effect of 40 hrs. solution
A-87	A	B	46231	1100	2 mdw	Effect of 40 hrs. solution
A-88	A	C	46038	1100	2mdw	Weld FZ Baseline
A-89	A	C	46039[3]	1100	2 mdw	Weld FZ Baseline
A-90	A	C	46041	1100	2 mdw	Weld HAZ Baseline
A-91	A	C	46042[4]	1100	2 mdw	Weld HAZ Baseline
A-92	A	D	46113	1100	2 mdw	40 Sol. Hrs. on weld FZ
A-93	A	D	46114	1100	2 mdw	40 Sol. Hrs. on weld HAZ
A-94	A	D	46115	1100	2 mdw	40 Sol. Hrs. on weld HAZ
A-95	A	E	9031	1100	10 cpm	HIP Weld Baseline
A-96	A	E	46036	1100	2 mdw	HIP Weld Baseline
A-97	A	E	46037	1100	2 mdw	HIP Weld Baseline
A-98	A	F	9032[6]	1100	10 cpm	40 Sol. Hrs. on HIP weld
A-99	A	F	46118	1100	2 mdw	40 Sol. Hrs. on HIP weld
A-100	A	F	46119	1100	2 mdw	40 Sol. Hrs. on HIP weld

Notes:
1. A: Cast Plates by Precision Castparts Corp. Heat: 41214
2. A: FHT: Stabilized + Solution + Aged
   B: FHT + 8X (5 hrs. Sol. + Age)
   C: Stabilized + Solution + Weld +FHT
   D: C + 8 X (5 hrs. Sol. + Age)
   E: Weld + HIP + FHT
   F: Weld + HIP + FHT + 8 X (5 hrs. Sol. + Age)
3. Poor data fit; Not used for comparisons.
4. Crack grew primarily in base metal.
5. Grip failure; No Data
6. Invalid; Crack grew out of plane. R= .7 test.

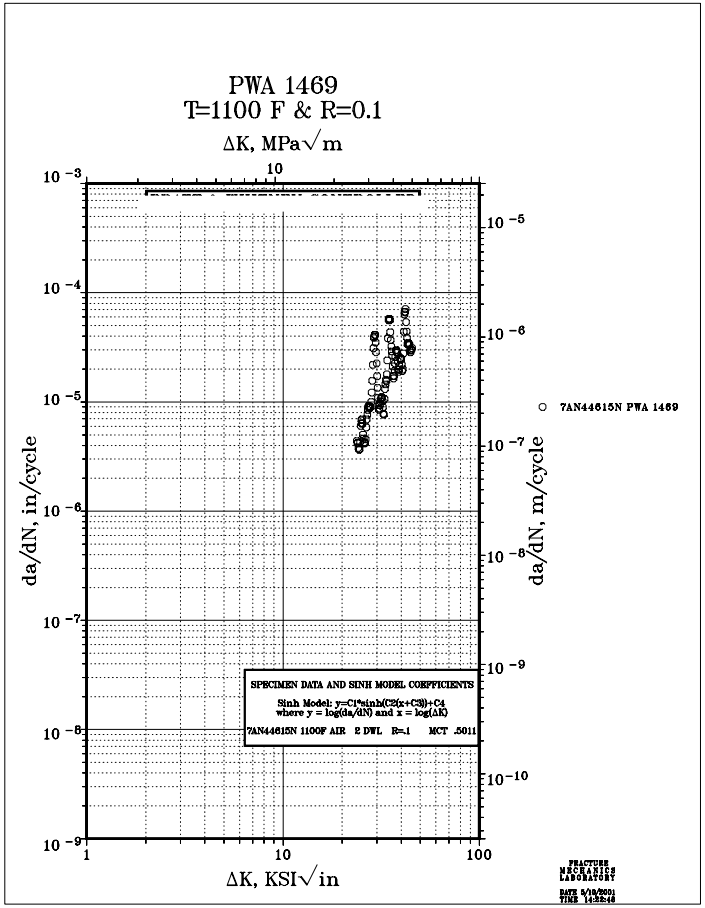
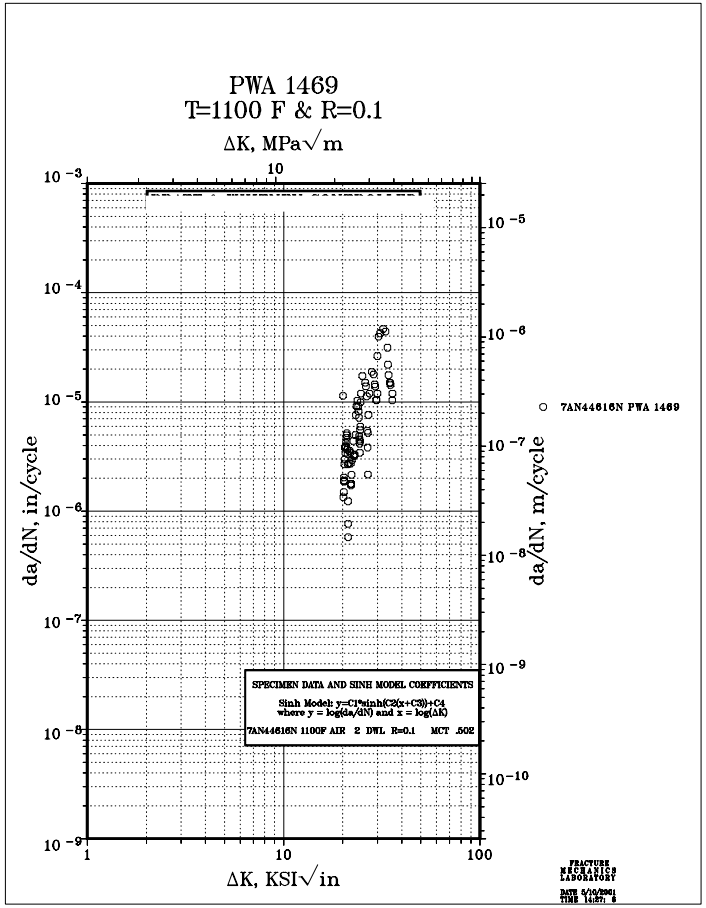


Chart A-82



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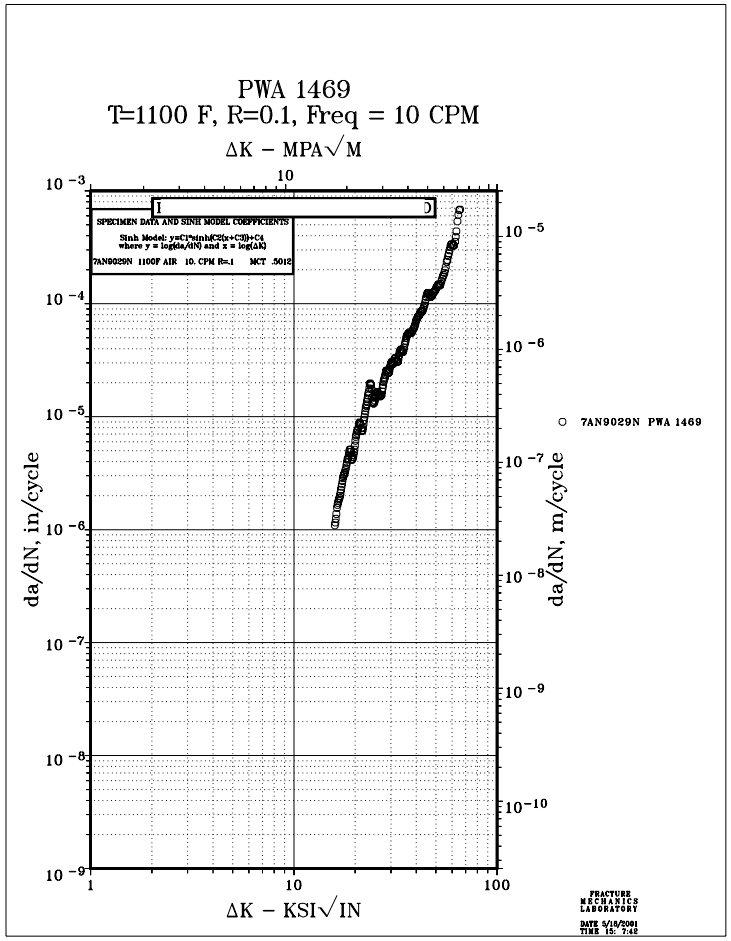

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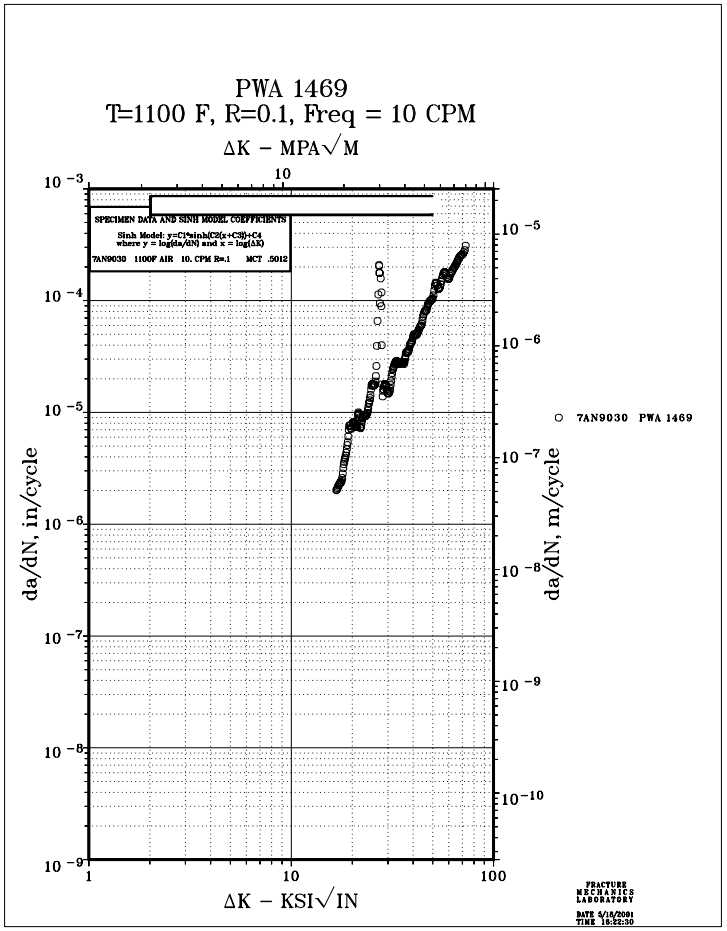

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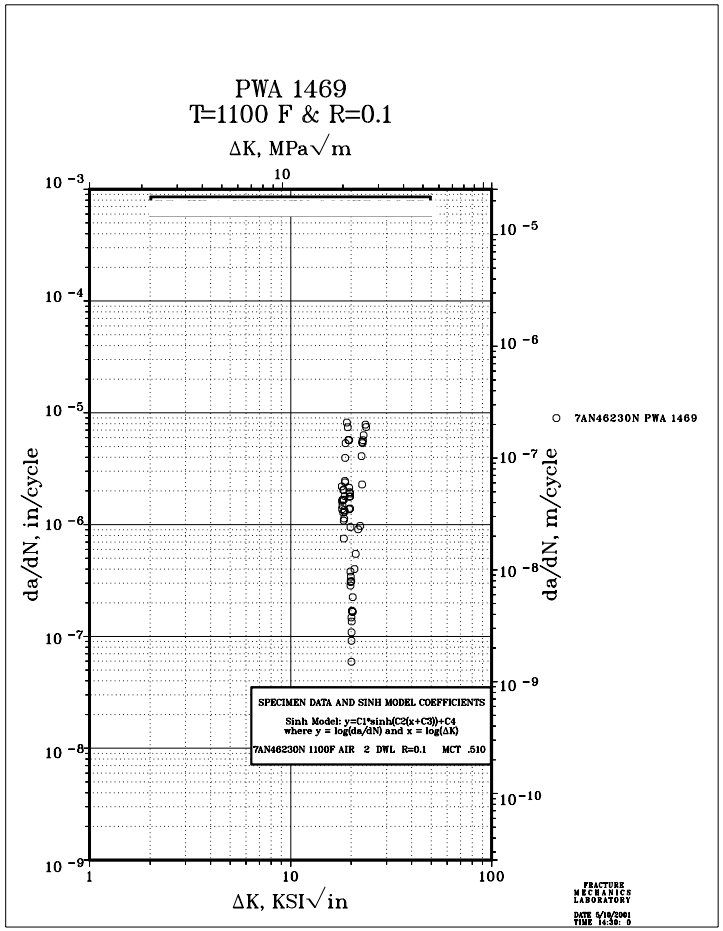

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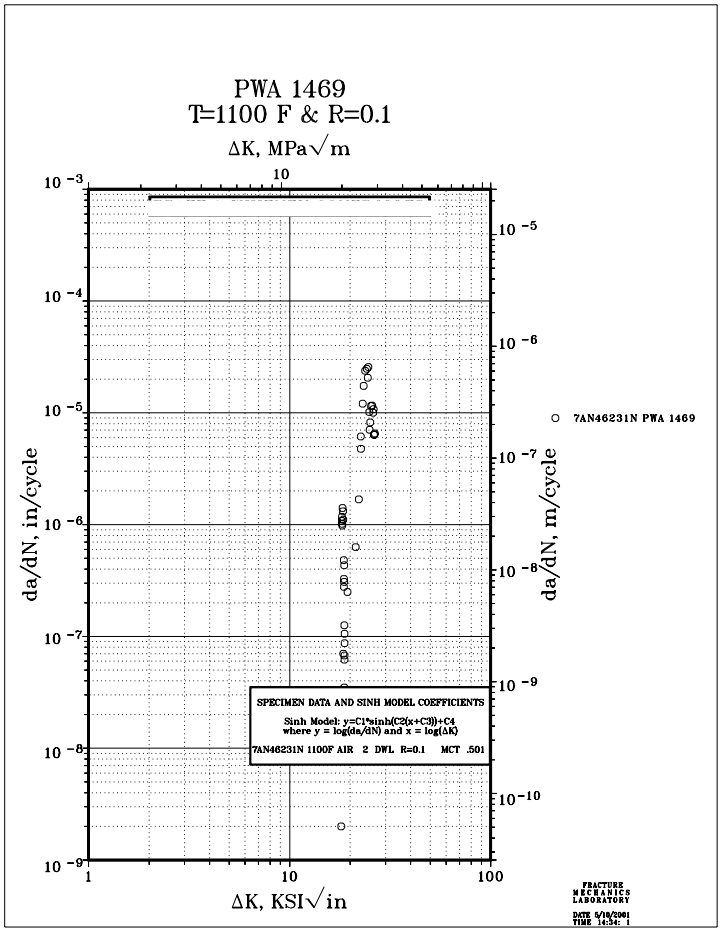

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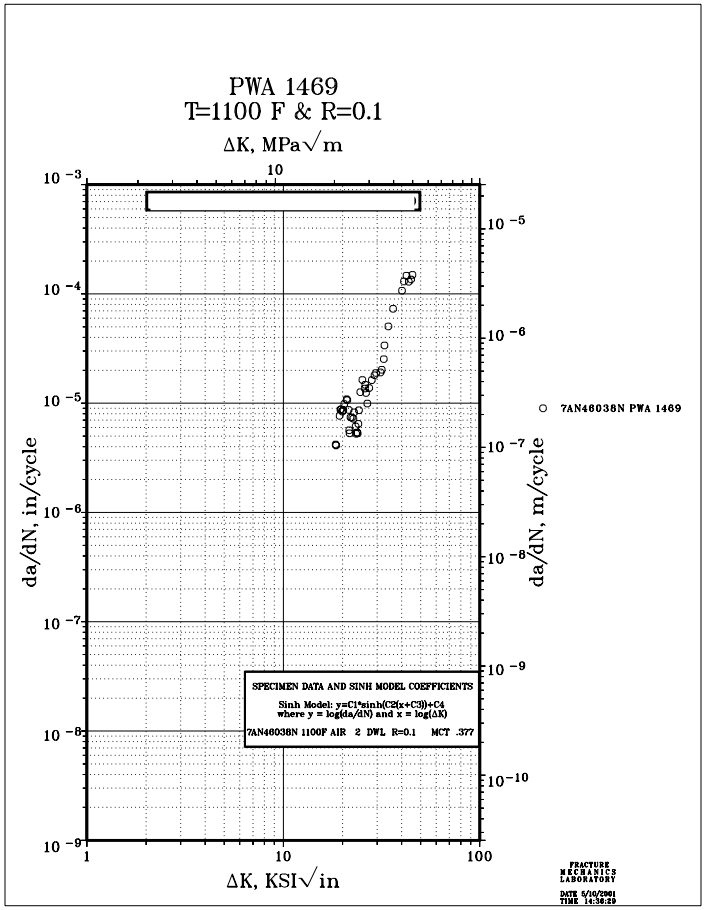

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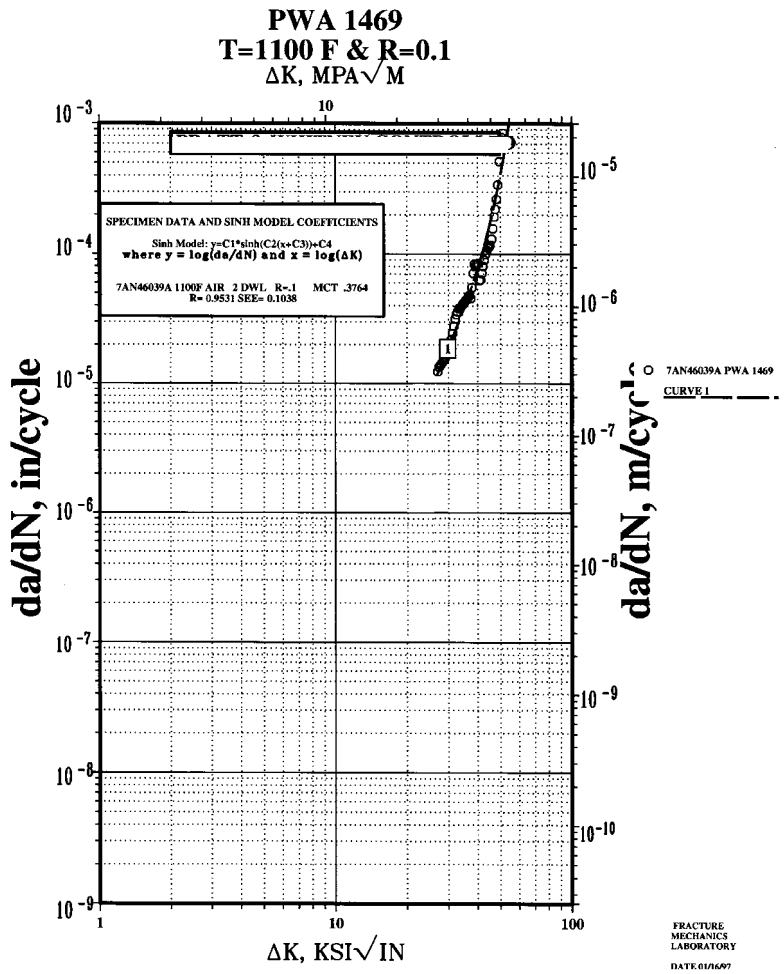

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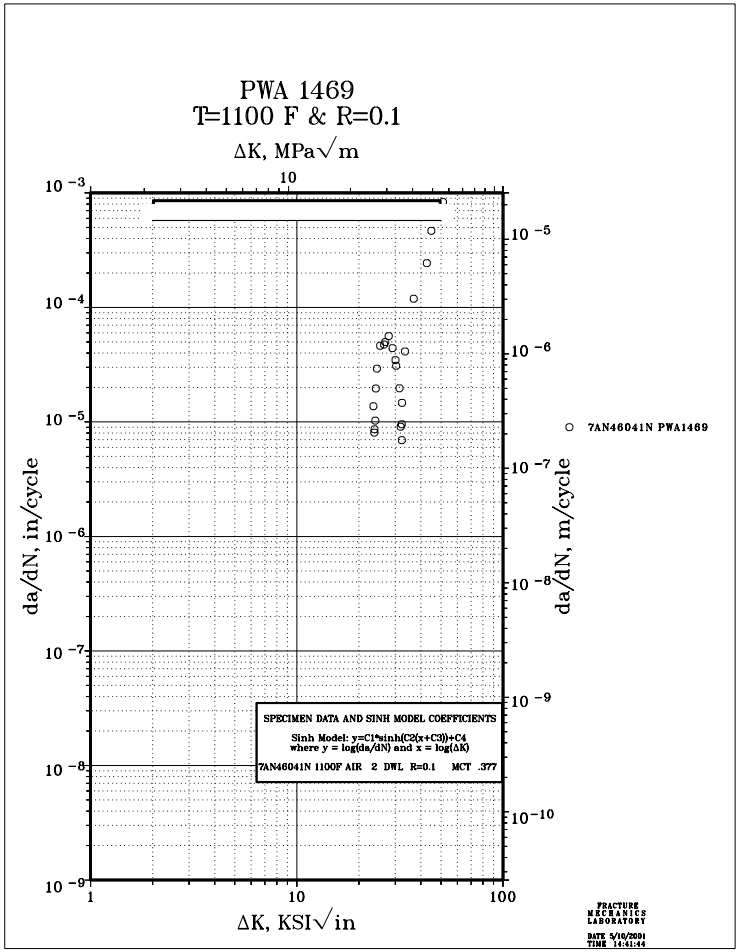

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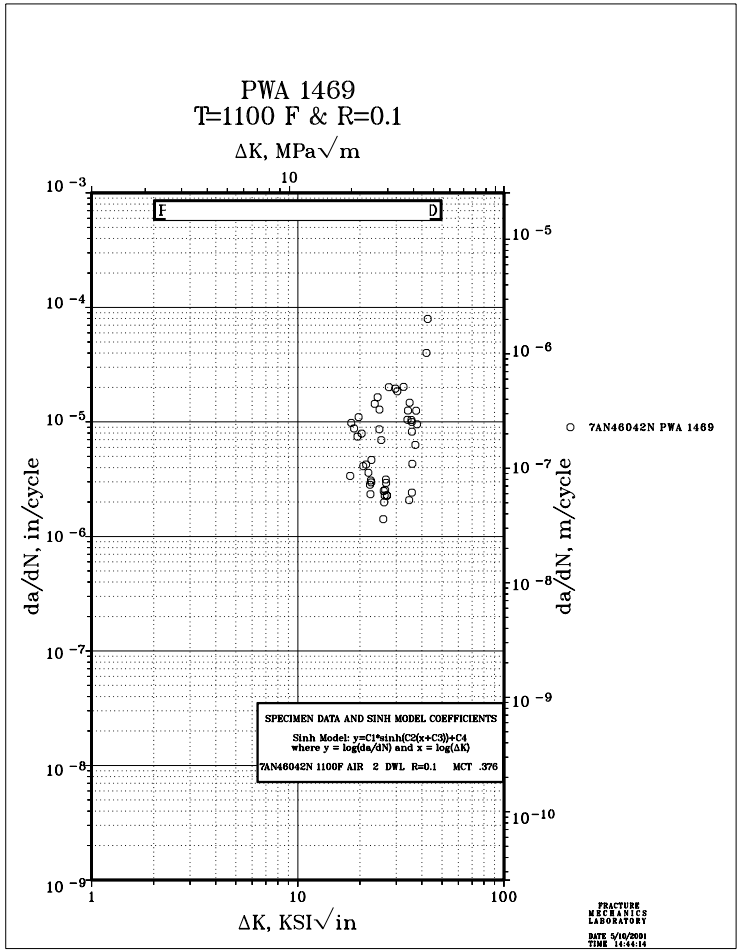
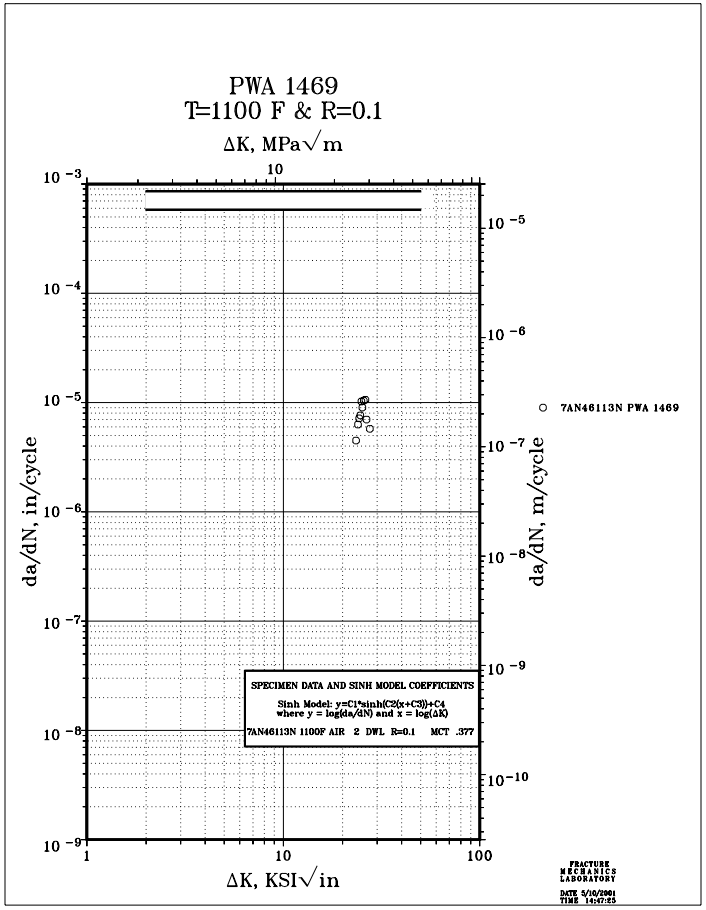


Chart A-91



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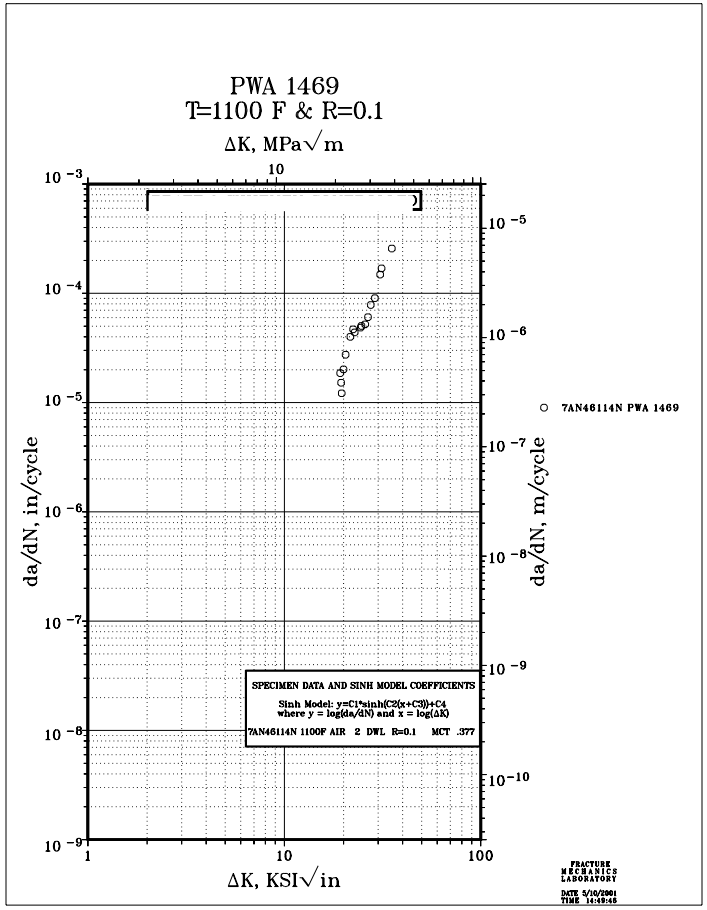

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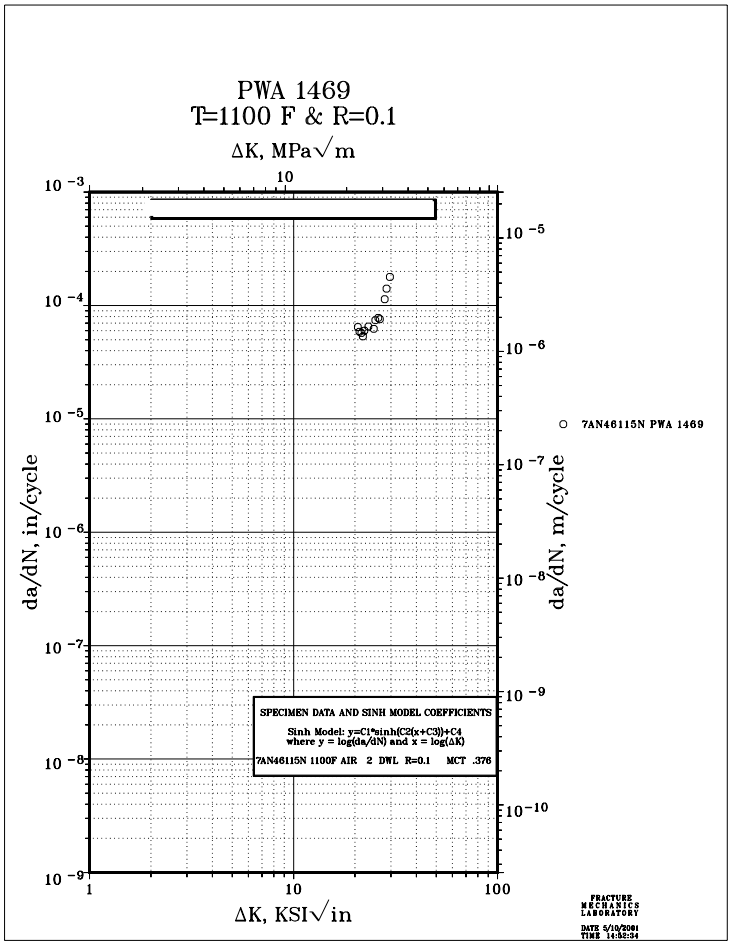

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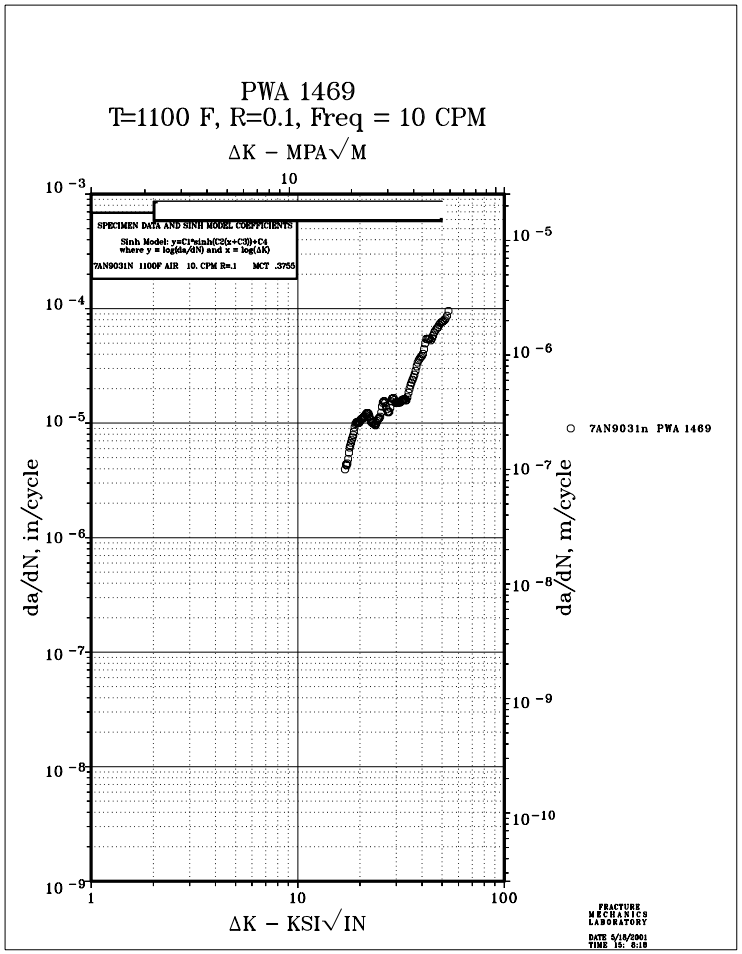


Chart A-95

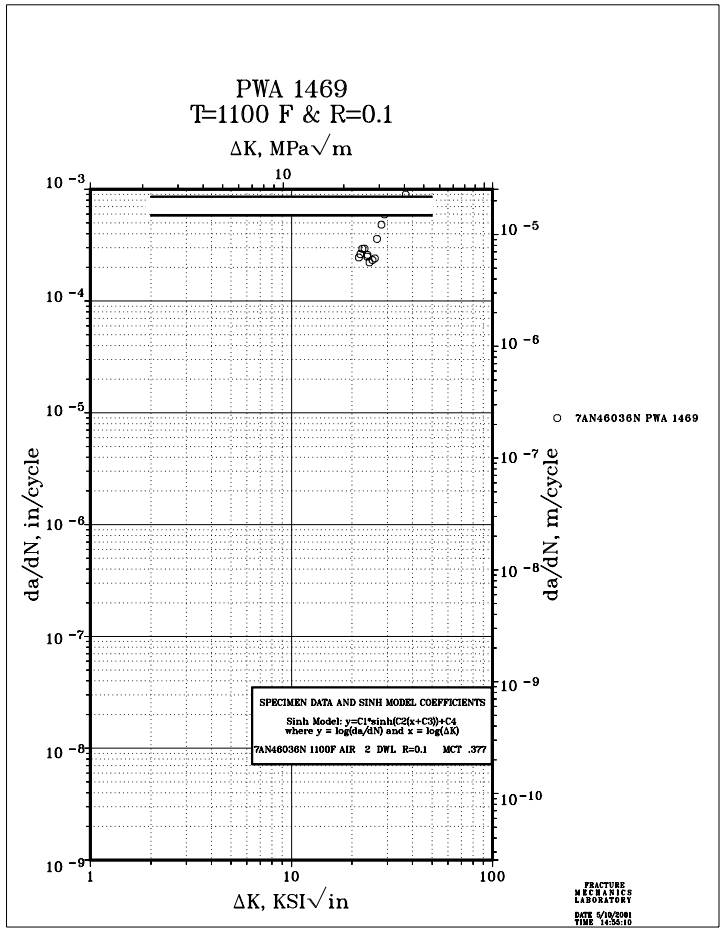
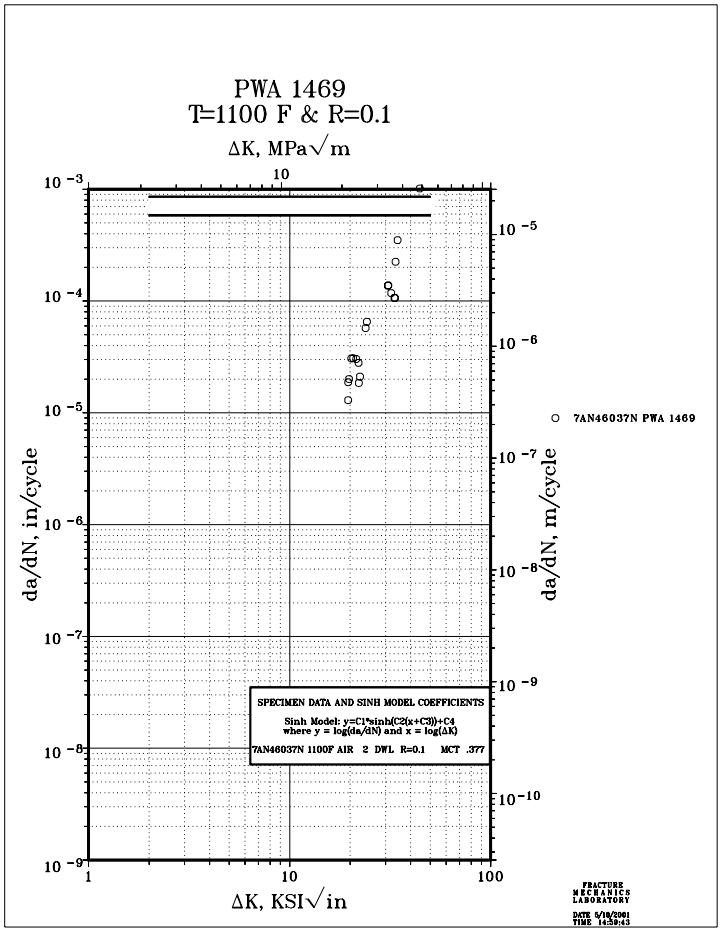


Chart A-96



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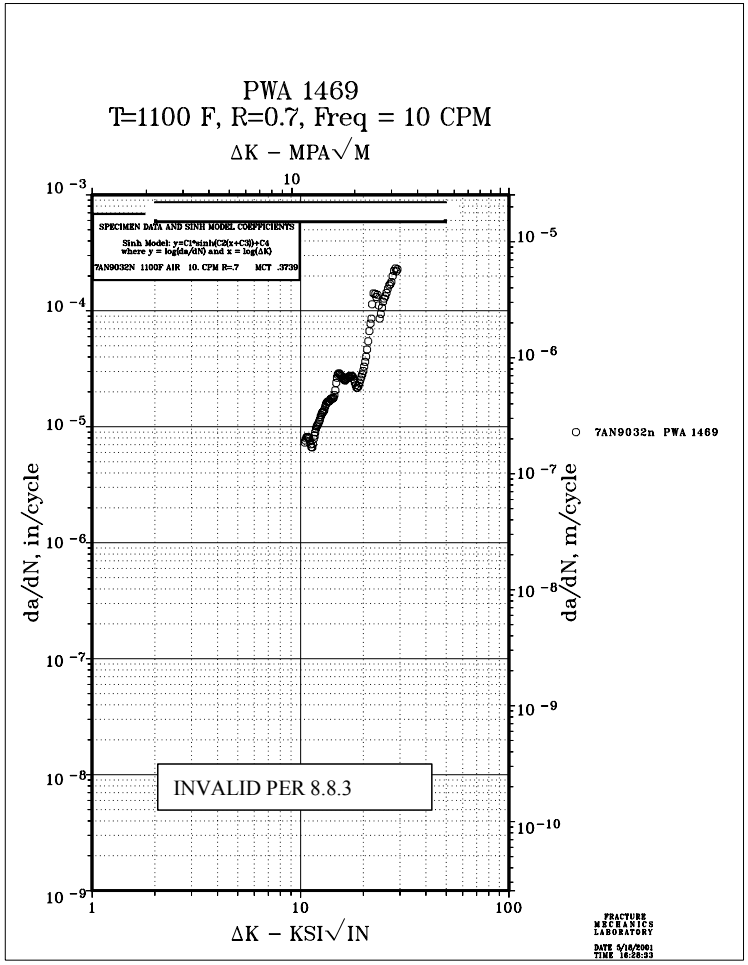

Chart A-98 Invalid Test

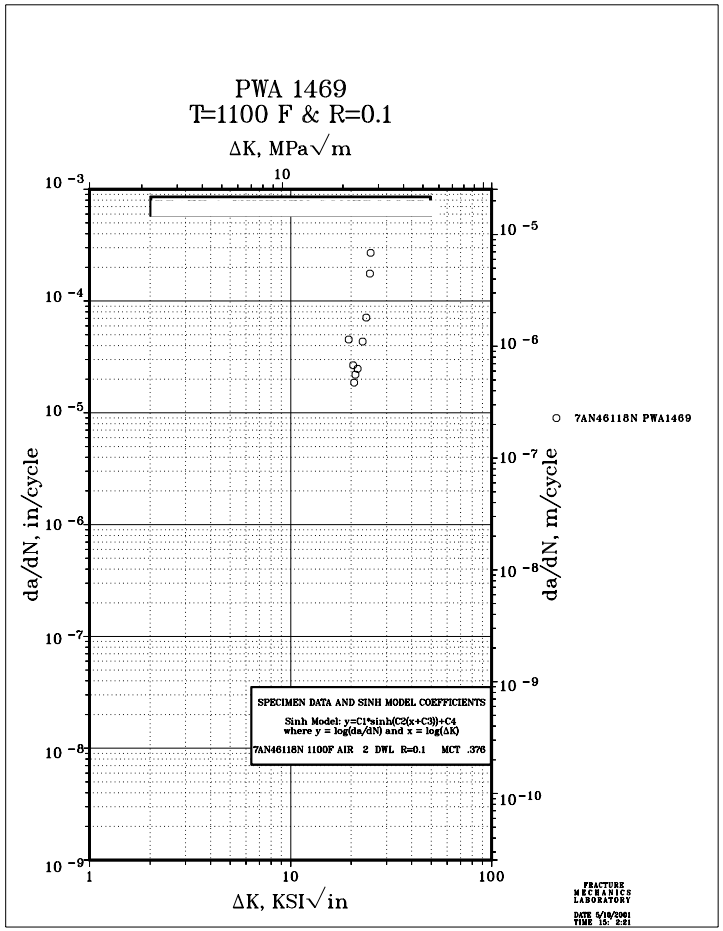

Chart A-99

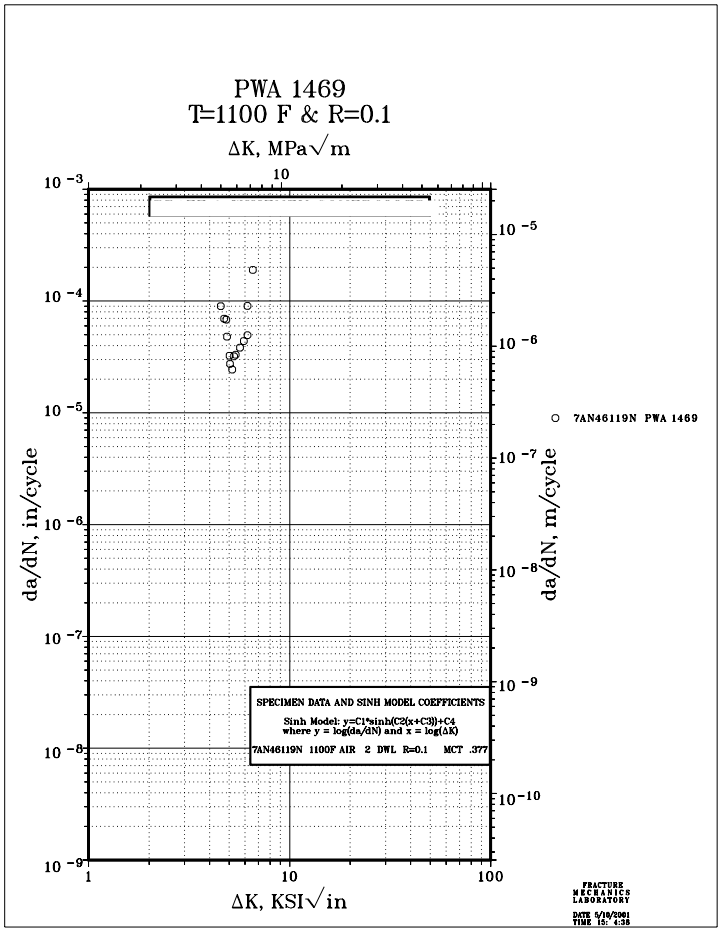

Chart A-100

A.5 JT9D DIFFUSER SPECIMENS da/dN PLOTS.

No.	Material Source[1]	S/N[2]	Specimen Number	Test Temp.(°F)	Cyclic Rate
A-101	OPW Center	BW0976	41159	800	10 cpm
A-102	OPW Center	BW0976	43383	1000	2 mdw
A-103	OPW Center	BW0976	41158	1100	2 mdw
A-104	OPW Center	BW0976	41160	1100	2 mdw
A-105	OPW Center	AG9961	41823	800	10 cpm
A-106	OPW Center	AG9961	41824	1100	2 mdw
A-107	OPW Center	CJ3225	41825	800	10 cpm
A-108	OPW Center	CJ3225	43383	1000	2 mdw
A-109	OPW Center	CJ3225	41826	1100	2 mdw

Notes: 1. JT9D Diffuser Case Outer Pressure Wall Center Ring
2. BW0976 Operated by British Airlines for 63,092 hours/13,696 cycles
AG9961 Operated by Japanese Airlines for 53,487 hours/23,869 cycles
CJ3225 Operated by Japanese Airlines for 60,307 hours/19,260 cycles.

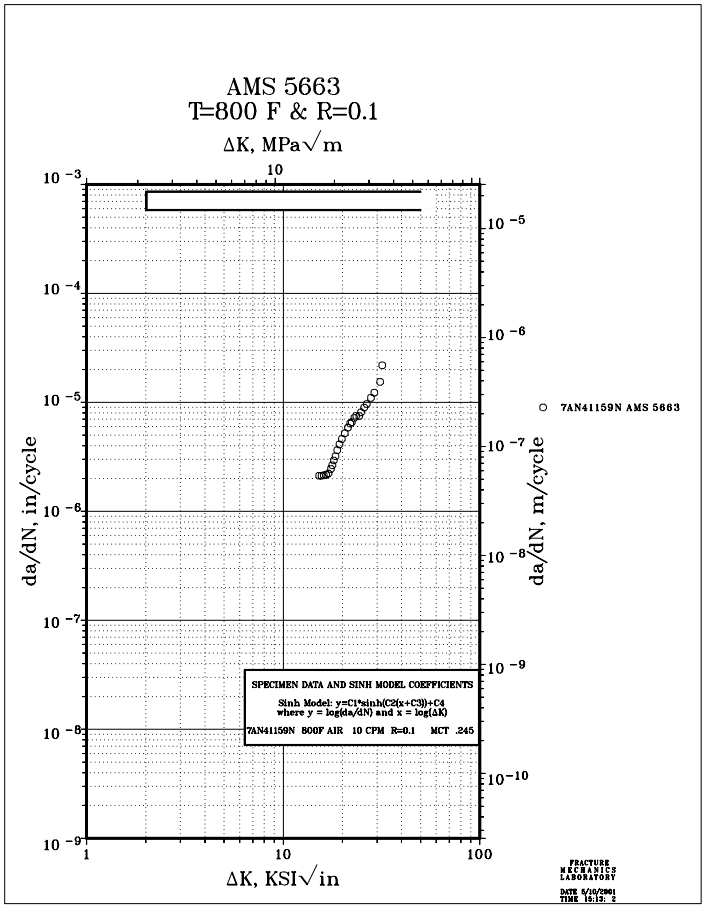

Chart A-101

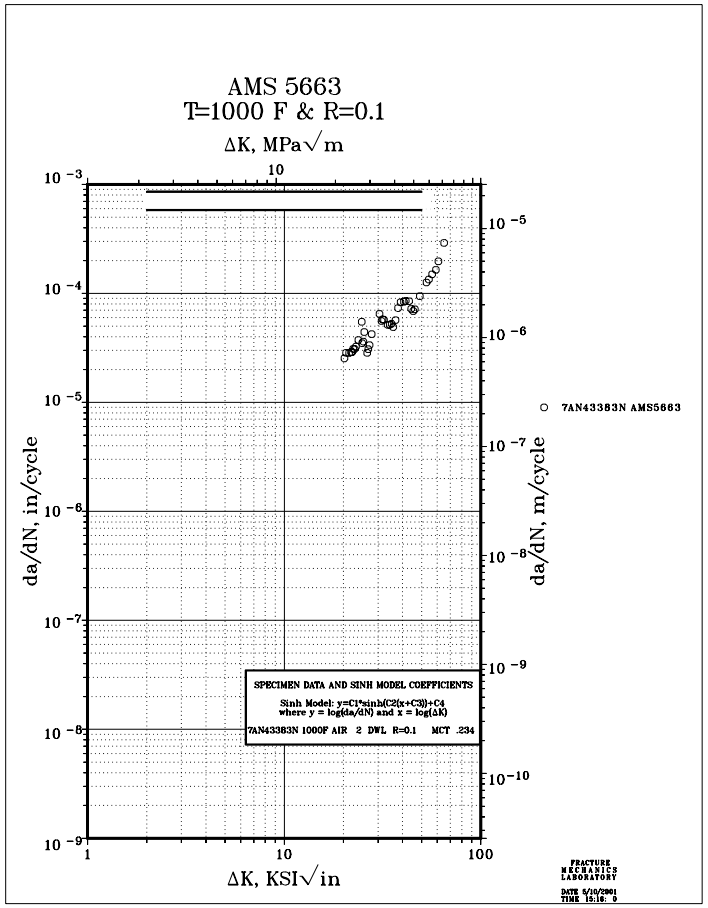

Chart A-102

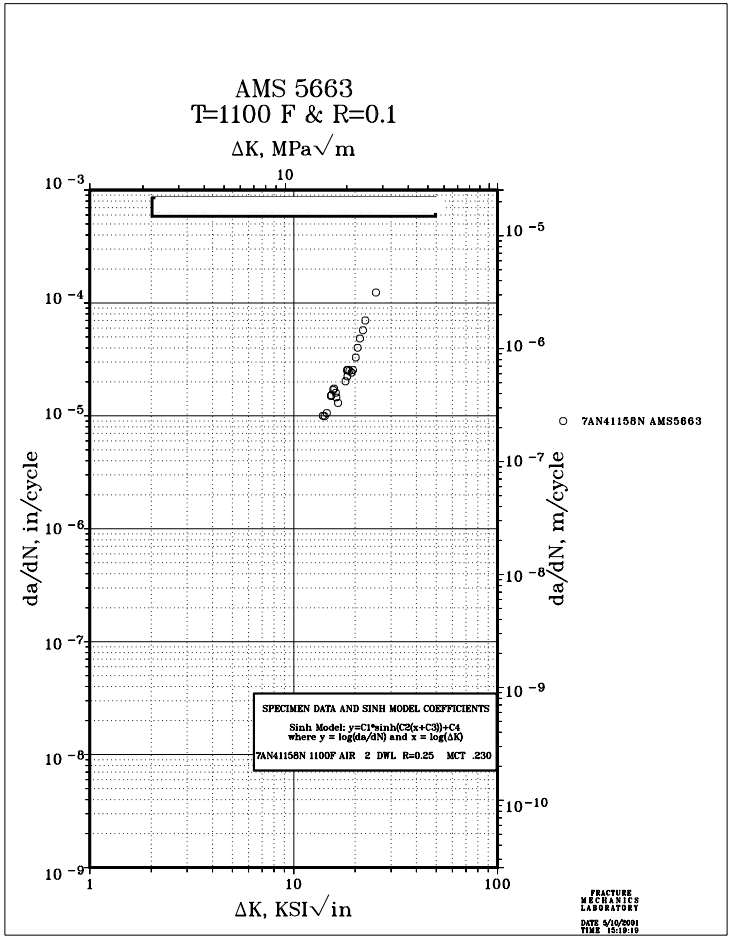

Chart A-103

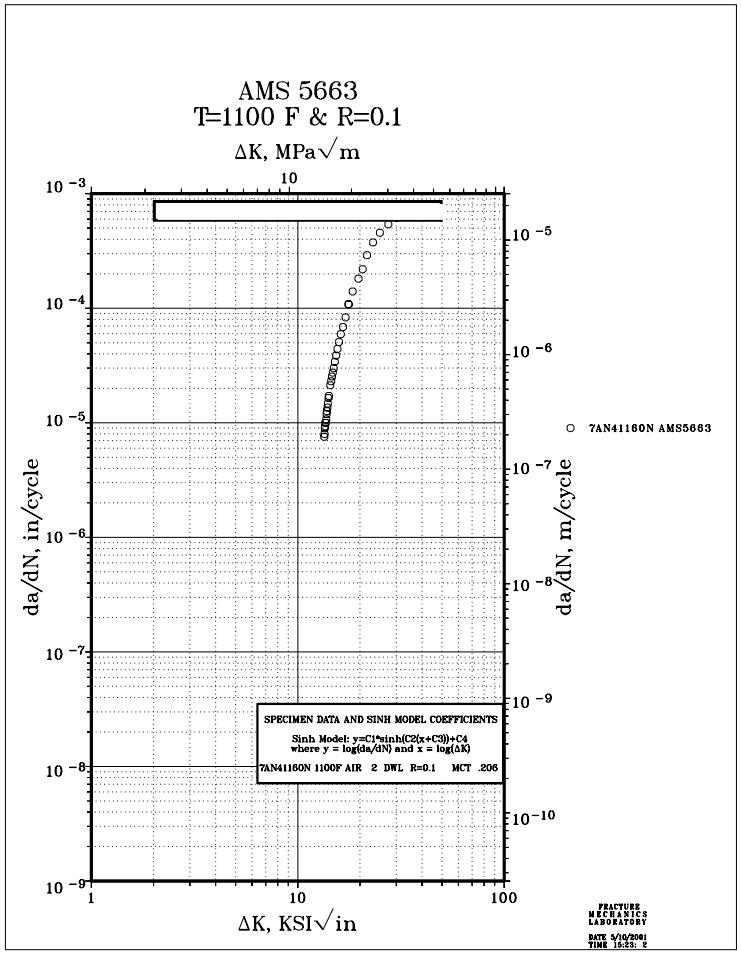

Chart A-104

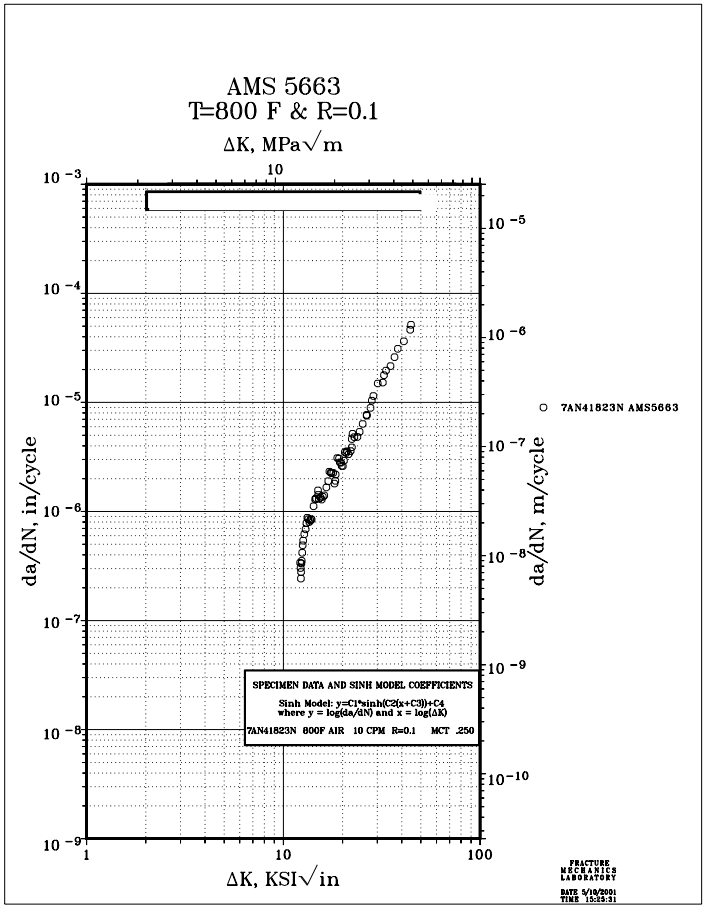

Chart A-105

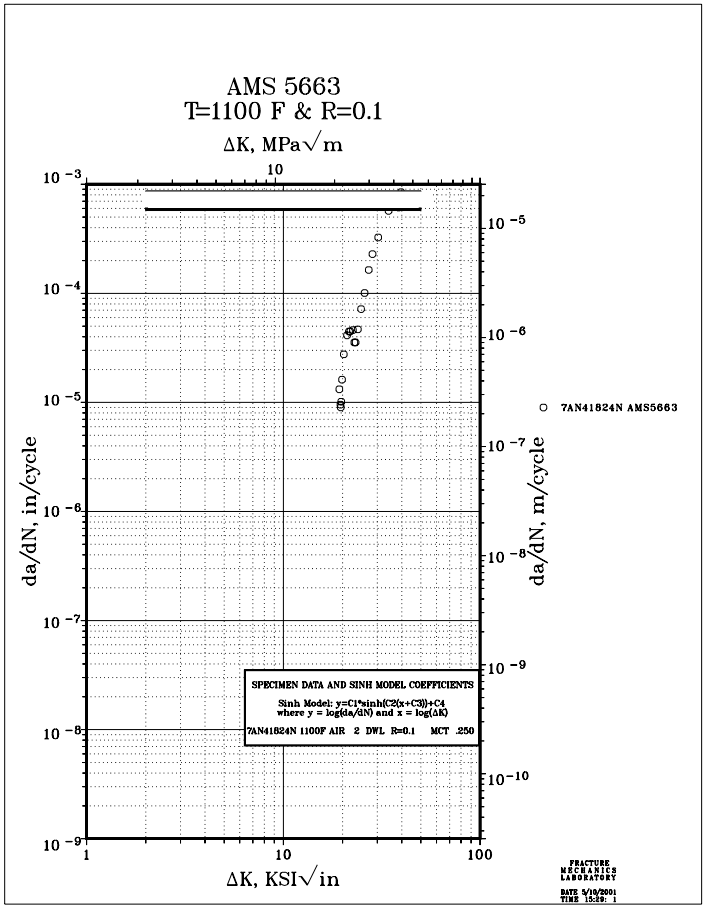

Chart A-106

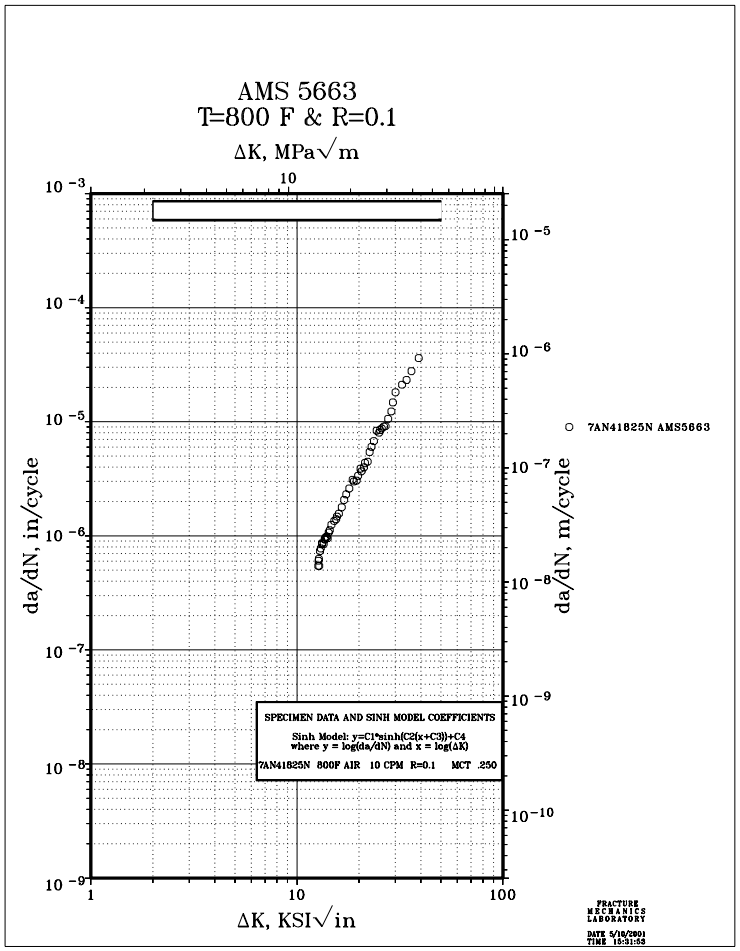

Chart A-107

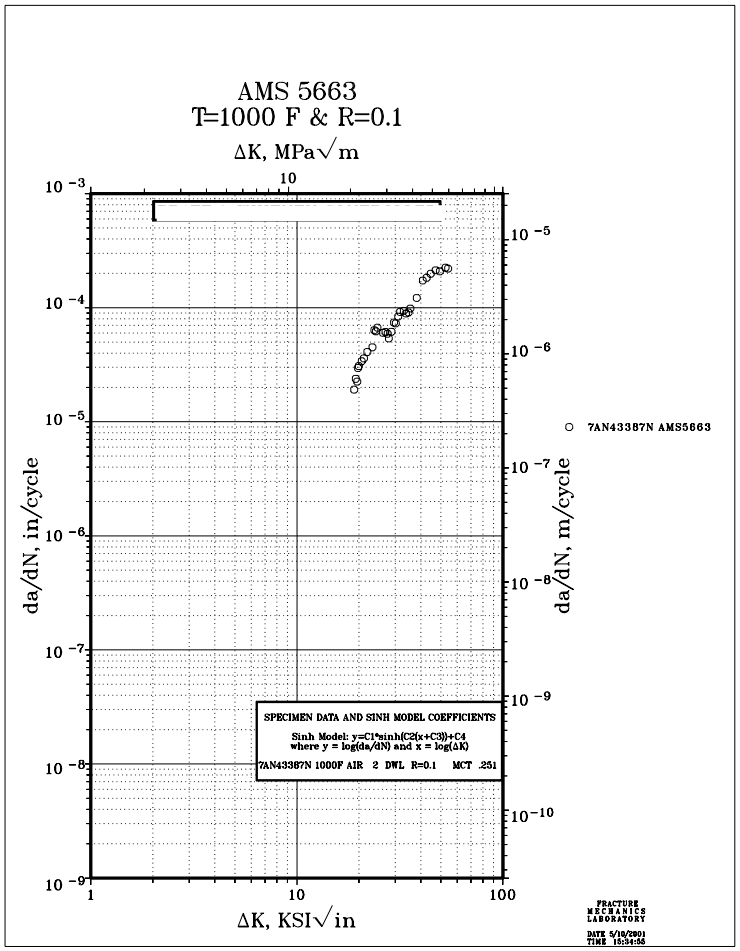

Chart A-108

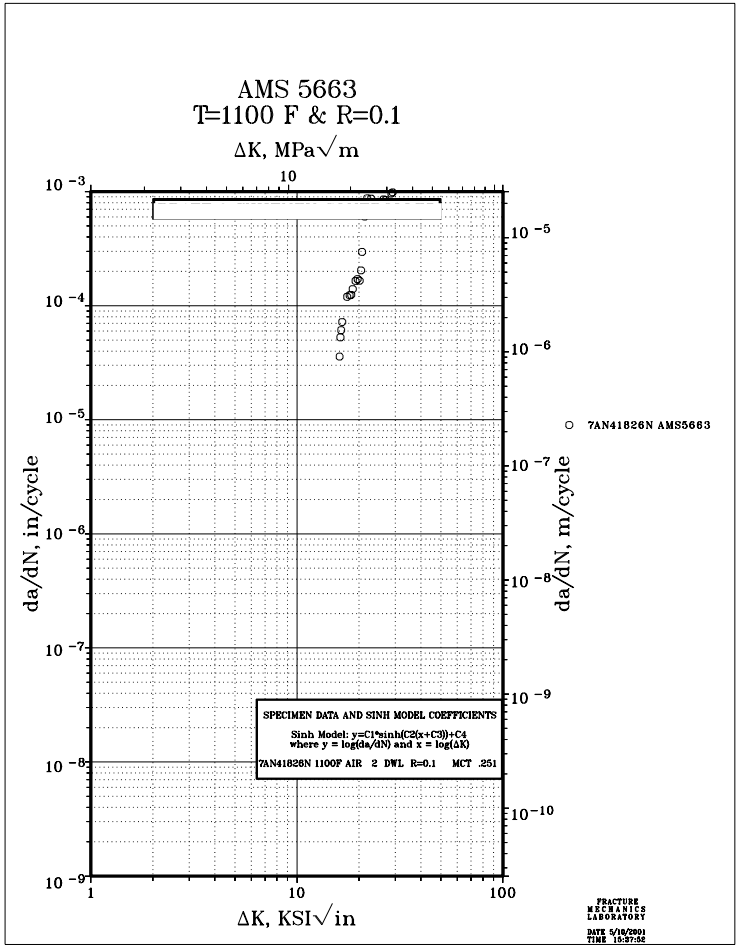
AMS 5663
T=1100 F & R=0.1
ΔK, MPa√m
10
da/dN, in/cycle
da/dN, m/cycle
7AN41826N AMS5663
SPECIMEN DATA AND SINH MODEL COEFFICIENTS
Sinh Model: y=C1*sinh(C2(x+C3))+C4
where y = log(da/dN) and x = log(ΔK)
7AN41826N 1100F AIR 2 DWL R=0.1 MCT .251
ΔK, KSI√in
FRACTURE MECHANICS LABORATORY
DATE 5/18/2001
TIME 15:37:52

Chart A-109