Elastic-Plastic Characterization of a Cast Stainless Steel Pipe Elbow Material

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Prepared by
J. A. Joyce/USNA
E. M. Hackett, C. Roe/DTRC

U.S. Naval Academy

David Taylor Research Center

Prepared for
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Prepared by
J. A. Joyce, U.S. Naval Academy
E. M. Hackett*, C. Roe, David Taylor Research Center

U.S. Naval Academy
Annapolis, MD 21402

David Taylor Research Center
Annapolis, MD 21402

Prepared for
Division of Engineering
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555
NRC FIN B6290

*Presently with the U.S. Nuclear Regulatory Commission

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ABSTRACT

Tests conducted in Japan as part of the High Level Vibration Test (HLVT) program for reactor piping systems revealed fatigue crack growth in a cast stainless steel pipe elbow. The material tested was equivalent to ASME SA-351CF8M. The David Taylor Research Center (DTRC) was tasked to develop the appropriate material property data to characterize cyclic deformation, cyclic elastic-plastic crack growth and ductile tearing resistance in the pipe elbow material.

The tests conducted included monotonic and cyclic tensile tests, monotonic J-R curve tests, and cyclic elastic and elastic-plastic fatigue crack growth rate tests. The cyclic elastic-plastic fracture behavior of the stainless steel was of primary concern and was evaluated using a cyclic J-integral approach. The fracture surfaces of selected specimens were examined in a scanning electron microscope (SEM) to determine the operative fracture micro-mechanism(s).

It was found that the cast stainless steel was very resistant to ductile crack extension. J-resistance curves essentially followed a blunting behavior to very high J levels. High cycle fatigue crack growth rate data obtained on this stainless steel was typical of that reported in standard textbooks. Low cycle fatigue crack growth rate data obtained on this material using the cyclic J integral approach was consistent with the high cycle fatigue crack growth rate and with a standard textbook correlation equation typical for this type of material. Evaluation of crack closure effects was essential to accurately determine the crack driving force for cyclic elastic-plastic crack growth in this material. SEM examination of several of the cyclic J test fracture surfaces indicated that fatigue was the primary mode of fracture with ductile crack extension intervening only during the last few cycles of loading. SEM examination also revealed secondary fatigue cracks which propagated inward from the side grooves for the $R = 0$ and $R = 0.3$ specimens. These secondary cracks were likely the cause of observed inaccuracies in the compliance estimated crack lengths for these specimens.

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Prior reports in this series are listed below:

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The HLVT project was performed by BNL and the Nuclear Power Engineering Center (NUPEC) as part of a nuclear power technical cooperative agreement between the USNRC and the Ministry of International Trade and Industry in Japan. The test results are reported in NUREG/CR-5585.

Introduction

Tests conducted in Japan as part of the High Level Vibration Test (HLVT) program for reactor piping systems revealed fatigue crack growth in a cast stainless steel pipe elbow.⁽¹⁾ The material tested was equivalent to ASME SA-351CF8M. Upon detailed examination of the fracture surfaces from the HLVT elbow test, it was found that both fatigue and ductile tearing were present concurrently, leading to the postulate that the crack growth may have been "J-controlled." In support of analyses being conducted by the Brookhaven National Laboratory (BNL), the David Taylor Research Center (DTRC) was tasked to develop the appropriate material property data to characterize cyclic deformation, cyclic elastic-plastic crack growth and ductile tearing resistance in the pipe elbow material. A complete list of the specimens tested in this program and some basic information on each test is given in Table 1. Tests conducted included standard tensile tests, standard ASTM E813-87 J_{Ic} measurements, and J-R curve tests according to ASTM E1152-87. Standard fatigue crack growth rate tests were conducted following ASTM E647-88a. Non standard tests were also used in this program to develop cyclic tensile properties and elastic-plastic, cyclic J, crack growth rate data. The methods used for these tests are described fully in this report. Scanning electron microscope fractography was used on several specimens to investigate several problems and inconsistencies that developed during this study.

1.0 MATERIAL CHARACTERIZATION

1.1 Chemistry

The chemistry of the HLVT elbow material was determined by DTRC and meets the specifications given for ASME A351 grade CF-8M and is presented in Table 2.

1.2 Metallography

A macroetch was performed on a cross section of the pipe material using Marble's reagent (Fig. 1) in order to determine the details of the processing history. The grain were found to be elongated in the direction of the radial axis of the pipe cross section and curved in a fashion that is characteristic of a centrifugal casting.⁽²⁾ Due to the irregularities in shape, an average grain size determination was impracticable.

Table 1. Description of Specimens Tested in This Program

Test Condition	Specimen I.D.	Specimen Orientation
Static Tensile	GPQ-29	L
Static Tensile	GPQ-30	L
Static Tensile	GPQ-31	L
Static Tensile	GPQ-32	L
Static Tensile	GPQ-35	L
Static Tensile	GPQ-37	L
Cyclic Tensile	GPQ-33	L
Cyclic Tensile	GPQ-34	L
Cyclic Tensile	GPQ-36	L
High Cycle Fatigue	GPQ-5	L-C
High Cycle Fatigue	GPQ-15	L-R
Cyclic J, R = -1	GPQ-2	L-C
Cyclic J, R = -1	GPQ-7	L-C
Cyclic J, R = -1	GPQ-16	L-R
Cyclic J, R = -1	GPQ-17	L-R
Cyclic J, R = 0.3	GPQ-8	L-C
Cyclic J, R = 0.3	GPQ-20	L-R
Cyclic J, R = 0.0	GPQ-9	L-C
Cyclic J, R = 0.0	GPQ-11	L-C
Cyclic J, R = 0.0	GPQ-23	L-R
Cyclic J, R = 0.0	GPQ-25	L-R
J-R 1T	GPQ-38	L-C
J-R 1T	GPQ-39	L-C
J-R 1/2T	GPQ-3	L-C
J-R 1/2T	GPQ-12	L-C
J-R 1/2T	GPQ-18	L-R
J-R 1/2T	GPQ-19	L-R
J-R 1/2T	GPQ-26	L-R

Table 2. Chemical Analysis of the HLVT Program Stainless Steel Pipe Elbow

Element	Analysis Wt%	A351-CF-8M
Carbon	0.048	0.08 max.
Manganese	1.00	1.5 max.
Silicon	0.91	1.50 max.
Phosphorous	0.023	0.04 max.
Sulfur	0.004	0.04 max.
Chromium	17.8	18 to 21
Nickel	11.0	10 to 12
Molybdenum	2.09	2 to 3

2.0 TENSILE PROPERTIES

2.1 Monotonic Tensile Properties

Round tensile specimens were prepared in a longitudinal orientation with respect to the pipe and tested in accordance with ASTM Standard E8. Three specimens had 0.505 inch (12.5 mm) diameters and 2 inch (51 mm) gage lengths, the remaining three specimens had 0.252 inch (6.4 mm) diameters and 1 inch (25 mm) gage lengths. The resulting tensile mechanical properties are presented in Table 3.

Table 3. Monotonic Tensile Properties of Cast Stainless Steel

Diameter	Yield Stress	Ultimate Tensile Stress	Fracture Stress	Elongation	Reduction in Area
(in)	(ksi)	(ksi)	(ksi)	(%)	(%)
0.505	38.4	77.2	54.8	52	80
0.505	39.9	76.8	56.6	54	78
0.505	38.6	79.2	59.6	64	76
0.252	38.1	75.1	47.4	48	84
0.252	44.7	76.9	58.8	49	78
0.252	42.0	79.0	60.5	--*	--*

*Note: Specimen was necked outside the gage length, therefore the test was terminated and elongation and reduction in area could not be determined.

2.2 Cyclic Tensile Properties

Cyclic loading tensile properties were obtained in the following manner. Standard round tensile specimens of 0.252 inch (6.4 mm) diameter and 1 inch (25 mm) gage length were axially, cyclically, loaded to produce cyclic stress-strain curves as shown in Figs. 2-4. The initial axial displacement was taken to approximately 0.003 inch (0.08 mm), then the specimen was unloaded to zero load. Subsequent displacement steps consisted of increments of approximately 0.001 inch (0.025 mm). Data was taken continuously and stored in digital form. Each cycle had a duration of approximately six seconds, though this varied as the test proceeded because the specimens became more compliant as the area was reduced and the length was increased.

Specimens GPQ-33 and GPQ-36 were run until the 50% strain limit was reached on the strain transducer, while specimen GPQ-34 fractured outside the gage length after a uniform strain of approximately 20% was achieved. These specimens demonstrated highly anisotropic and heterogeneous behavior as shown in Fig. 5.

The upper envelope of the cyclic stress strain curve is shown for one specimen in Fig. 6. Since the hydraulic machine was operating in axial displacement control the upper stress varied considerably from cycle to cycle as shown on Fig. 6. This cyclic upper stress strain envelope is compared to the results of the static tensile tests in Fig. 7. Fig. 7 shows that the cyclic loading tends to soften the material as far as ultimate strength is concerned and to increase the apparent ductility. An exact comparison, however, cannot be made since the cyclic tensile specimens were extended only to the limit of the elongation transducer, hence not fractured.

Fig. 1. Macroetch of Section Through Cast Stainless Steel
HLVT pipe elbow

Figure 2 - Cyclic Tensile Specimen Engineering Stress-Strain Curve
Using $R = 0.0$ Strain Controlled Cyclic Loading -
Specimen GPQ-33

Figure 3 - Cyclic Tensile Specimen Engineering Stress-Strain Curve
Using $R = 0.0$ Strain Controlled Cyclic Loading -
Specimen GPQ-34

Figure 4 - Cyclic Tensile Specimen Engineering Stress-Strain Curve
Using $R = 0.0$ Strain Controlled Cyclic Loading -
Specimen GPQ-36

Figure 5 - Tensile Specimen of Cast Stainless Steel Showing Anisotropic Deformation

Figure 6 - Cyclic Tensile Stress-Strain Envelope for the Cast
Stainless Steel Specimen GPQ-33

Figure 7 - Cyclic Tensile Stress-Strain Envelope and Static Tensile Stress-Strain Data for the Cast Stainless Steel

3.0 MONOTONIC J-R CURVE BEHAVIOR

J-R curves were evaluated using the ASTM Standard E1152-87. The specimens used were 1T and 1/2T C(T) specimens according to E1152 with 1T specimens removed only in the L-C orientation (due to material thickness) and 1/2T specimens removed in both L-R and L-C orientations. A single specimen unloading compliance technique was utilized as described by Joyce and Gudas.⁽³⁾ The resulting J-R curves are shown in Fig. 8 along with blunting line constructions of $J = 2\sigma_F\Delta$ and $J = 4\sigma_F\Delta a$. It is clear from these results that this material follows a path between these blunting lines and does not fracture by ductile tearing, at least until well beyond the standard E1152 validity regions for 1/2T and 1T specimens. These validity regions are shown in Fig. 8 for comparison. This material is too tough to be characterized by the J-integral method using 1/2T or 1T specimens.

4.0 FATIGUE CRACK GROWTH RATE BEHAVIOR

4.1 Linear Elastic Fatigue Crack Growth

The specimens prepared for fatigue crack growth rate (FCGR) testing were 1/2T C(T) specimens machined with integral knife edges for loadline crack-opening displacement (COD) measurements as shown in Fig. 9. The tests were run within the requirements of ASTM Standard E647-88a. A computer was used to estimate the crack growth using an elastic compliance equation for C(T) specimens. Tests were run in an increasing K mode at a constant frequency of 0.1 Hz and a minimum/maximum load ratio (R ratio) of 0.1. Data was stored digitally at increments of 0.010 inches (0.25 mm) of crack growth. Two specimens were tested, one in the L-C orientation, the other in the L-R orientation. The results of these tests are shown and compared to the Rolfe/Barsom⁽⁴⁾ fatigue crack propagation equation for austenitic stainless steels in Fig. 10.

4.2 Elastic-Plastic Fatigue Crack Growth

Cyclic J-testing was utilized to evaluate the crack growth resistance of the material under intense cyclic loading. It has been shown by several authors⁽⁵⁻⁸⁾ that an operational J-integral range correlates the fatigue crack growth under cyclic growth conditions beyond that of linear elastic fracture mechanics as standardized by ASTM E647. In this work the load histories shown in Figs. 11-13 were used and will be referred to as the R=0, R=0.3 and R=-1 load histories respectively. The "R=-1" case had, in fact, a range of negative R ratios, initially with $-1 < R < 0$, then for a few cycles with R=-1, and then for the remainder of the test, R was between -1 and -10 as the tensile load capacity of the specimen diminished.

The specimens used for these tests were 1/2T C(T) specimens, as previously described and shown in Fig. 9, with integral knife edges and 20% total side grooves. Both L-R and L-C orientations were tested. Compression loading was applied to these specimens using fixtures known as load caps which are shown in Fig. 14. Basically, the clevis pin holes were toleranced such that on reversal of the test machine, load was applied to the specimen via the load caps instead of the loading pins. This system was a variant of that used by Joyce⁽⁸⁾ for reversed loading cyclic fatigue/fracture tests, the improvement

here was that the compression load caps stayed in place during both the compression and tensile loadings.

The J-integral was calculated on each cycle using the Merkle-Corten⁽⁹⁾ J equation as modified by Clarke and Landes⁽¹⁰⁾ to give:

$$J = \frac{\eta A}{B_n b} \quad (1)$$

with: B_n = net specimen thickness,
 b = (W-a) is the specimen's remaining ligament,
 A = the area enclosed by the load-COD cyclic curve as
described further below.

and,

$$\eta = 2 \left[\frac{(1 + \alpha)}{(1 + \alpha^2)} \right], \quad (2)$$

with

$$\alpha = \{2 (a/b)^2 + 2 [2 (a/b)] + 2\}^{1/2} - [2 (a/b) + 1]. \quad (3)$$

(Text Continues on Page 21)

Figure 8 - Monotonic J-R Curves for the Cast Stainless Steel

Figure 9 - 1/2T C(T) Specimen with Integral Knife Edges

Figure 10 - High Cycle Fatigue Crack Growth Data for Cast Stainless Steel Showing Comparison with Rolfe and Barsom Fit

Figure 11 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, $R=0$, $1/2T$ C(T) Specimen GPQ-11

Figure 12 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, $R=0.3$, $1/2T$ C(T) Specimen GPQ-20

Figure 13 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, $R=-1$, $1/2T$ C(T) Specimen GPQ-16

Figure 14 - Improved Load Cap Fixtures for 1/2T C(T) Specimens

The cyclic area was calculated as shown schematically in Fig. 15. The cyclic area, shown cross-hatched, is bounded by the loading portion of the load-COD curve, by a maximum COD vertical line and along the bottom by a crack closure load horizontal line. The critical calculation is to evaluate the crack closure load. This was done in this work by comparing the slope during the initial cycle loading with the slope of the first unloading portion of the previous cycle. The basic method is to fit a quadratic polynomial to the initial load versus COD data as:

$$P = A_1 + A_2 COD + A_3 COD^2 \quad (4)$$

Then the slope is given by:

$$k_I = A_2 + 2 A_3 COD, \quad (5)$$

and this can be set equal to the previous unloading slope, k^* to give:

$$k^* = k_I = A_2 + 2 A_3 COD. \quad (6)$$

Solving for the closure COD gives:

$$COD^* = \frac{k^* - A_2}{2 A_3}, \quad (7)$$

and then P^* at closure can be evaluated from Eq. 4.

The crack length was evaluated for each cycle using the unloading compliance equations of ASTM E1152-87 including the rotation correction. For each load cycle specimen compliance, crack length, the correlation of the least squares fit and maximum COD were measured and stored on magnetic disk. Also stored was a file giving load-COD pairs tracing out each cycle for post test processing for closure load, cyclic area and cyclic J.

Figure 15 - Schematic of USNA/DTRC Analysis for Crack Closure Load

5.0 FRACTOGRAPHY

Fractographic examinations of several of the tested specimens were conducted in order to evaluate the micro-mechanisms of fracture. The examinations were performed using both light optical and scanning electron microscopy (SEM) and included the following specimens:

Table 4 Specimens Analyzed With the Scanning Electron Microscope

Specimen	R Ratio	Condition
GPQ-15	0.1	Linear Elastic Cycling
GPQ-23	0.0	Elastic-Plastic Cycling
GPQ-20	0.3	Elastic-Plastic Cycling
GPQ-16	-1	Elastic-Plastic Cycling
GPQ-12	N/A	J-R Curve Test

Of particular interest in the examinations was ascertaining whether the fatigue crack growth during elastic-plastic cycling was interrupted by ductile tearing. Also of interest were the discrepancies between the final estimated and measured values of crack extension for the $R=0$ and $R=0.3$ tests (see Section 6.0).

Specimen GPQ-15 was tested in accordance with the ASTM E647-88a (linear elastic cycling) procedure. A low magnification photograph of the fracture surface is shown in Fig. 16. The fracture surface displayed fine ($1\mu\text{m}$) striations in the test region as shown in Fig. 17.

Specimen GPQ-23 was cycled in the elastic plastic region ($R=0$). The low magnification photograph (Fig. 18) shows three distinct regions of cyclic crack growth: a primary crack emanating from the fatigue precrack and two secondary fatigue cracks emanating inward from the side grooves. SEM examination confirmed the direction of the cyclic crack growth showing striations emanating from both the side grooves and the fatigue precrack in the appropriate regions. Striations emanating from the precrack are shown in Fig. 19 and were, on average, approximately $3\mu\text{m}$ in width in the test region directly ahead of the precrack. The cyclic crack growth from both the precrack and the side grooves, and the resulting crack front curvature, helps explain the discrepancies between the compliance and measured crack length estimates. The micro-mechanism of crack growth in the test region was fatigue which was interrupted by ductile tearing only near the very end of the fatigue cycling, apparently in just the last ten or so cycles when the cyclic J was a maximum and the specimen was distorted almost straight open in the load line.

Specimen GPQ-20 was also cycled in the elastic plastic region ($R=0.3$) and displayed primary cyclic crack growth from the precrack and the secondary fatigue cracks growing from the side grooves as shown in Fig. 20. The directions of the crack growth were confirmed by SEM examination of the fatigue striations. The striations directly ahead of the precrack averaged approximately $2\mu\text{m}$ in width (Fig. 21). As with GPQ-23, this also helps explain the discrepancies between the final estimated and measured values of fatigue crack growth in the $R=0.3$ specimens. The fatigue crack growth in the test region of GPQ-20 was also interrupted by ductile tearing only near the test end.

Figure 16 - Low Magnification Photograph of Fracture Surface of Specimen GPQ-15, Linear Elastic Cycling

Figure 17 - SEM Fractograph of Specimen GPQ-15 Showing Fine Fatigue Striations

Figure 18 - Low Magnification Photograph of Fracture Surface of Specimen GPQ-23, Elastic Plastic Cycling, $R=0$, Showing Primary and Secondary Cyclic Crack Growth

Figure 19 - SEM Fractograph of Specimen GPQ-23, Elastic Plastic Cycling, $R=0$, Showing Striations Immediately Ahead of the Fatigue Precrack

Figure 20 - Low Magnification Photograph of Fracture Surface of Specimen GPQ-20, Elastic Plastic Cycling, $R=0.3$, Showing Primary and Secondary Cyclic Crack Growth

Figure 21 - SEM Fractograph of Specimen GPQ-20, Elastic Plastic Cycling, $R=0$, Showing Striations Immediately Ahead of the Fatigue Precrack

Specimen GPQ-16 was subjected to fully reversed cyclic loading ($R=-1$). A low magnification photograph of the fracture surface is shown in Fig. 22. This specimen exhibited striation spacings as large as $40\mu\text{m}$ (Fig. 23) in the test region and ductile tearing as evidenced by microvoid coalescence near the end of the test region (Fig. 24). There was no evidence of cyclic crack growth from the side grooves and the compliance estimated and final measured values of crack extension were in good agreement for this specimen.

As expected, the J-R curve test specimen, GPQ-12, exhibited only ductile tearing throughout the test region as typified by Fig. 25.

In summary, fatigue as a micromechanism was interrupted by ductile tearing only near the ends of the elastic plastic cycled specimens. Fatigue crack growth from the side grooves appears to have contributed to the discrepancies between the final estimated and measured values of crack extension for the $R=0$ and $R=0.3$ specimens.

Figure 22 - Low Magnification Photograph of Fracture Surface of Specimen GPQ-16, Elastic Plastic Cycling, $R=-1$

Figure 23 - SEM Fractograph of Specimen GPQ-16, Elastic Plastic Cycling, $R=-1$, Showing Fatigue Striations Ahead of the Fatigue Precrack

Figure 24 - SEM Fractograph of Specimen GPQ-16, Elastic Plastic Cycling, $R=-1$, Showing Microvoid Coalescence Near the End of the Test Region

Figure 25 - SEM Fractograph of Specimen GPQ-12, J-R Curve Test, Showing Microvoid Coalescence in the Test Region

6.0 DISCUSSION

6.1 Cyclic J Data

As described in Section 4.0, the specimen compliance was calculated while the test was in progress, the crack length was calculated, then stored and this process was repeated for each cycle. Only a small part of the data used to calculate the crack lengths was stored and these crack length estimates were taken as the best measure of crack length for each cycle, i.e. they could not be improved by post test processing. Typical data is shown for four of the $R=-1$ specimens in Fig. 26. Compliance estimates of crack length were generally very consistent and appeared repeatable to a precision of about ± 0.001 inch (0.03 mm). For the $R = -1$ specimens, the initial and final compliance estimated crack lengths were shown to be accurate in comparison with 9-point average crack lengths measured optically from the specimen fracture surfaces after the test. These results are shown in Table 5. The $R = 0.0$ or $R = 0.3$ specimens, on the other hand, showed poor agreement between the compliance crack growth estimates and the optical measurements made after the tests were completed. The initial crack lengths were accurate in all cases, but in most cases the final crack lengths estimated by compliance were well short of the post test optical measurements. This was probably caused by the growth of secondary fatigue cracks in from each side groove on these specimens as described in the fractography section, Section 5.0. It could also be at least partly due to a failure of the rotation correction to handle the gross opening deformation that occurred in these specimens.

The $R=0$ and $R=0.3$ cases did not appear to demonstrate a crack closure phenomena for this material, even for the most intense loading cycles. For these specimens, the minimum load on each cycle was taken as the lower bound load for the cyclic area and cyclic J calculation. The $R=-1$ case demonstrated crack closure and required the calculation of a closure load for each cycle before the cyclic area and cyclic J could be calculated. The method used for this was discussed in the previous section. Results for the four $R=-1$ specimens are shown in Fig. 27. At the beginning, the method generally finds a closure load near the minimum (compression) load in each cycle. Some variability is shown on Fig. 27 for specimen GPQ-16 for the first few cycles, but basically a rather steady, negative closure load is located before 25 cycles have been applied to the specimen. This closure load then remains nearly constant throughout the remaining cycles until the tensile load capacity is reached and the COD steps of 0.004 inch (0.1 mm) are applied. When this happens, the closure load returns toward zero load if the test is not terminated first due to COD transducer limitations.

J

The closure load of between -500 and -1000 lbs. is well above the -2500 lbs. minimum load applied to the R=-1 specimens. The use of the minimum load in the cyclic J calculation rather than the closure load would have dramatically increased the cyclic J values resulting in an erroneous calculation of the applied cyclic J.

Figures 28, 29 and 30 show cyclic J as a function of cycle count for the R=0, R=0.3 and R=-1 cases respectively. For the cyclic loading used here, the cyclic J range experienced by the R=0 and R=0.3 cases is very limited, while for the R=-1 case a wide range of cyclic J was sampled by each specimen. In all cases the cyclic J is seen to be a smooth function of cycle count which can be utilized to obtain a da/dN versus ΔJ fatigue crack growth rate characterization of the material.

(Text Continues on Page 40)

Figure 26 - Crack Length vs. Cycle Count for Cast Stainless Steel
R = -1 C(T) Specimens

Figure 27 - Closure Load vs. Cycle Count for Cast Stainless Steel
R = -1 C(T) Specimens

Figure 28 - J Range vs. Cycle Count for Cast Stainless Steel R = 0
C(T) Specimens

Figure 29 - J Range vs. Cycle Count for Cast Stainless Steel
R = 0.3 C(T) Specimens

Figure 30 - J Range vs. Cycle Count for Cast Stainless Steel
R = -1 C(T) Specimens

Figure 31 - Crack Growth Rate for Cast Stainless Steel
 $R = 0$ C(T) Specimens

Figure 32 - Crack Growth Rate for Cast Stainless Steel
 $R = 0.3$ C(T) Specimens

Figure 33 - Crack Growth Rate for Cast Stainless Steel
 $R = -1$ C(T) Specimens

The final step is shown in Figs. 31-33 for the $R=0$, $R=0.3$ and $R=-1$ cases. Since the J range sampled by the $R=0$ and $R=0.3$ cases is limited, only limited fatigue crack growth data is obtained from each of these specimen taken independently. A combined plot showing one specimen of each orientation and R ratio is shown in Fig. 34. It is clear that the $R=0$ and $R=-1.0$ data sets define a single power law relationship while the $R=0.3$ case seems to demonstrate somewhat accelerated crack growth. The excellent comparison between the estimated and measured crack lengths for the $R=-1$ specimens, shown in Table 5, verifies the validity of the crack growth rates for these specimens. The reason for the higher apparent crack growth in the $R=0.3$ specimens is not understood and probably should be investigated further. It is quite possibly the result of the secondary fatigue cracks observed growing from the side grooves on these specimens, but it seems that if this was the only cause of the accelerated growth in the $R = 0.3$ specimens, the $R = 0.0$ specimens should also have demonstrated the higher growth rate since they also were observed to have secondary fatigue cracks growing inward from the sidegrooves. The optically measured crack extensions obtained from the $R=0.3$ specimens, shown in Table 5, demonstrate that more crack growth occurred in these specimens than was estimated by the compliance method. This suggests that the crack growth rate was greater than that shown in Fig. 34. In most cases the L-R orientation appeared to demonstrate slightly slower crack growth rates than the L-C orientation.

Table 5. Estimated vs. Measured Crack Growth for Cyclic Crack Growth Rate Tests and J-R Curve Tests of Cast Stainless Steel

Test Condition	Specimen I.D.	Estimated Crack Growth (in)	Measured Crack Growth (in)	Specimen Orientation
High Cycle Fatigue	GPQ-5	0.106	0.124	L-C
	GPQ-15	0.083	0.115	L-R
Cyclic J R = -1	GPQ-2	0.353	0.368	L-C
R = -1	GPQ-7	Not Available	Not Available	L-C
R = -1	GPQ-16	0.352	0.378	L-R
R = -1	GPQ-17	0.323	0.350	L-R
R = 0.3	GPQ-8	0.091	0.123	L-C
R = 0.3	GPQ-20	0.095	0.151	L-R
R = 0.0	GPQ-9	0.071	0.094	L-C
R = 0.0	GPQ-11	0.104	0.162	L-C
R = 0.0	GPQ-23	0.100	0.143	L-R
R = 0.0	GPQ-25	0.110	0.161	L-R
J-R 1T	GPQ-38	0.112	0.119	L-C
J-R 1T	GPQ-39	0.113	0.130	L-C
J-R 1/2T	GPQ-3	0.038	0.05	L-C
J-R 1/2T	GPQ-12	0.040	0.047	L-C
J-R 1/2T	GPQ-18	0.035	0.030	L-R
J-R 1/2T	GPQ-19	0.039	0.026	L-R
J-R 1/2T	GPQ-26	0.025	0.030	L-R

Figure 34 - Crack Growth Rate for Cast Stainless Steel - Combining All Three R Ratios

6.2 Combined Cyclic K and J Results

It was originally observed by Dowling and Begley⁽¹¹⁾ that cyclic K and J data can be combined on a single plot using the equation originally proposed by Rice⁽¹²⁾ that:

$$K^2 = J * E', \quad (8)$$

where:

$$E' = \frac{E}{1 - \nu^2} \quad (9)$$

E = material elastic modulus

ν = material Poisson ratio

Such a plot for this material is shown in Fig. 35 and includes the high cycle ΔK results of the FCGR tests and the low cycle ΔJ results of the elastic-plastic tests. Also shown on Fig. 35 is a correlation equation for austenitic stainless steel from the standard textbook of Rolfe and Barsom,⁴ and a set of Japanese¹ data from the HLVT program previously used to characterize this material. It was clear that in terms of J range the high and low cycle work done as a part of this study are consistent, and in close agreement with the standard textbook equation. The Japanese data differ by approximately one order of magnitude. The details of the methods used to obtain the Japanese data were not known except that the specimens were oriented in the L-C orientation and were of 1T scale. From our experience on this project it also appears that the Japanese data were obtained using a negative R ratio cyclic load history since this is the only way in which such large cyclic K or J ranges could be achieved. An attempt was made as a part of the project to simulate the Japanese data by re-analyzing our R=-1.0 data using another analysis and method to define the closure load. Since ΔJ (or ΔK) can only be increased by reducing the closure load, the first assumption was to use the minimum load for closure and to calculate ΔJ and then ΔK using the full area under each load cycle. The effect this had on a particular specimen is shown in Fig. 36. As expected the data was shifted to higher ΔK values at corresponding crack growth rates. A comparison of the adjusted data and the Japanese data is shown in Fig. 37. The correspondence is clearly excellent.

In an attempt to explain the rate of fatigue crack growth in the HLVT pipe elbow structure, the closure load at which the crack opens must be accurately determined. Clearly, complete closure of the fatigue crack occurred at load levels well above the minimum compressive load achieved in the laboratory specimen used in this investigation. Such closure would also be expected in the actual structure (pipe elbow) and could be more significant in the structure than in the laboratory specimen. The Japanese data from the HLVT program appears to have been generated by assuming that the entire loading range (maximum tensile load to minimum compressive load) contributed

to the crack driving force. This has the net effect of lowering the overall crack growth rate for a given driving force (J-integral), as previously described. It is considered that this approach may not model the actual crack growth in the structure as well as applying laboratory data that has been properly adjusted for closure.

Figure 35 - Comparison of Japanese and DTRC/USNA Crack Growth Rates for Cast Stainless Steel

Figure 36 - DTRC/USNA Crack Growth Rates for Cast Stainless Steel with Different Closure Loads

Figure 37 - DTRC/USNA Crack Closure Rate for Cast Stainless Steel with the Closure Load Taken at the Minimum Load Compared with the Japanese Crack Growth Rate Results

7.0 CONCLUSIONS

The following conclusions are drawn from the work described in this report:

- (1) The HLVT pipe elbow stainless steel material is very resistant to ductile crack extension. J-resistance curves follow the blunting line to very high J levels, well beyond the standard validity region defined by ASTM E1152.
- (2) High cycle fatigue crack growth rate data obtained on this austenitic stainless steel is typical of that reported in standard textbooks.
- (3) Low cycle fatigue crack growth rate data obtained on this material using the cyclic J integral approach is consistent with the high cycle fatigue crack growth rate and with the standard textbook correlation equation typical for this type of material.
- (4) Very high fatigue crack growth rates, on the order of 0.02 inch/cycle (0.5 mm/cycle) were achieved in this study on very small 1/2T CT specimens. Ductile crack extension intervened only during the last few cycles, when the cyclic J was a maximum and the specimen was distorted almost straight open in the load line.
- (5) Evaluation of crack closure effects was essential to accurately determine the crack driving force for cyclic elastic-plastic crack growth in this material.
- (6) Secondary fatigue cracks were observed on the fracture surfaces of the $R = 0$ and $R = 0.3$ specimens. These secondary fatigue cracks were probably responsible for the inaccuracy of the compliance estimated crack growth in these specimens. Only a primary fatigue crack was observed on the $R = -1$ cyclic specimens and these specimens gave excellent agreement between the compliance prediction of crack length and the post test optical measurements.

8.0 RECOMMENDATIONS

Further FCGR tests with R ratios of 0.3 and with specimens of higher R ratios should be conducted to attempt to clarify the causes for the observed elevation in crack growth rate for the R=0.3 tests. Larger (1T) specimens should be used to allow obtaining higher cyclic J values and more crack growth during each separate test.

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APPENDIX A Digital Data Summary

A complete list of specimens tested in this program is shown in Table 1 in the main text, including the specimen type, loading type, and material orientation. Results from many of these specimens were presented in the main section, the remaining results are included here for completeness.

All data developed in this study was taken by digital data systems and stored on magnetic media, and thus the data is available for re-analysis. These figures are presented to give the reader an idea of the general behavior of each specimen and the data stored for each test. Some files are more than 1 Mbyte in length, but newer computer systems make processing these files straightforward.

The cyclic stress strain curves of Figs. 2-4 are the complete set of specimens that were run in this mode. Upper load envelope files like that of Fig. 5 were stored only for specimens GPQ-33 and GPQ-34. The envelope plot for specimen GPQ-34 is presented as Fig. A1, since it was not included in the main text. Attempts were made to tighten the test machine control so that the upper envelope was somewhat smoother on specimens GPQ-33, which was run subsequent to GPQ-34 and GPQ-36. The cyclic load envelope of GPQ-33 was somewhat improved, but still quite ragged in appearance.

Figures A2-A8 include the load versus COD records for all cyclic J fatigue crack growth rate tests that were run in this program and not presented in the main text. The corresponding figures in the body of this report are Figs. 11-13. Cyclic J, crack length, crack closure load, and crack growth rate were derived from these data sets as described in the main text and were presented there in Figs. 15-24.

The load versus COD plots for the unloading compliance J-R curve tests are presented in Figs. A9-A15. The J-R curves from all of these specimens except GPQ-26 were presented in Fig. 8 in the main text. Figure 8 with the J-R curve of specimen GPQ-26 added is shown in Fig. A16. GPG-26 clearly demonstrates a different, and more elevated J-R curve than the other specimens. The excess elevation of this specimen appears to have been caused by the failure of the specimen precrack to lie in the plane of the side grooves. Side grooves were machined into these specimens after precracking and in this one case the fatigue crack and side grooves were not co-planar. In most materials this is not a serious problem, the crack grows directly to the side groove and follows it from that point on without a measureable increase in toughness. In this material this is apparently not the case. The precrack was not initially in the plane of the sidegrooves and stayed out of the sidegroove plane for the small amount of crack growth that occurred, causing a dramatic elevation of its J-R curve with respect to the other specimens tested.

Figure A1 - Cyclic Tensile Stress-Strain Envelope for the Cast Stainless Steel Specimen GPQ-34

Figure A2 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, R=0, 1/2T C(T) Specimen GPQ-9

Figure A3 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, R=0, 1/2T C(T) Specimen GPQ-23

Figure A4 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, R=0, 1/2T C(T) Specimen GPQ-25

Figure A5 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, $R=0.3$, $1/2T$ C(T) Specimen GPQ-8

Figure A6 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, $R=-1$, $1/2T$ C(T) Specimen GPQ-2

Figure A7 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, $R=-1$, 1/2T C(T) Specimen GPQ-7

Figure A8 - Cyclic Load vs. COD Displacement Curve for Cast Stainless Steel, R=-1, 1/2T C(T) Specimen GPQ-17

Figure A9 - Unloading Compliance Load vs. COD Curve for Cast Stainless Steel J-R Curve Test, 1T C(T) Specimen GPQ-38

Figure A10 - Unloading Compliance Load vs. COD Curve for Cast Stainless Steel J-R Curve Test, 1T C(T) Specimen GPQ-39

Figure A11 - Unloading Compliance Load vs. COD Curve for Cast Stainless Steel J-R Curve Test, 1/2T C(T) Specimen GPQ-3

Figure A12 - Unloading Compliance Load vs. COD Curve for Cast Stainless Steel J-R Curve Test, 1/2T C(T) Specimen GPQ-12

Figure A13 - Unloading Compliance Load vs. COD Curve for Cast Stainless Steel J-R Curve Test, 1/2T C(T) Specimen GPQ-18

Figure A14 - Unloading Compliance Load vs. COD Curve for Cast Stainless Steel J-R Curve Test, 1/2T C(T) Specimen GPQ-19

Figure A15 - Unloading Compliance Load vs. COD Curve for Cast Stainless Steel J-R Curve Test, 1/2T C(T) Specimen GPQ-26

Figure A16 - Comparison of Baseline J-R Curves and Specimen GPQ-26 with Crack Extension Occurring Out of the Side Groove Plane

APPENDIX B - Tabular J-R Curve Data Summary

J-R curves for this cast stainless material have been presented in Fig. 8 in the main text. Load versus COD records for these unloading compliance tests were presented in Appendix A Figures A9-A16. This tabulated presentation includes intermediate quantities used for the calculations like the specimen stiffness, the correlation of the unloading data, the plastic area and the elastic and plastic J components.

UNL #	# DP	COD STIFFNESS lbs/in	CORR COEFF	AREA pl in-lbs	LOAD lbs	COD in	DELTA a in	J E813 in-lbs/sq in	J pl in-lbs/sq in
1	62	446430.5	0.99915	0.1	2370.6	0.00505	0.00343	21	0.3
2	75	448288.3	0.99986	0	3030.9	0.00653	0.00199	32.9	0.1
3	62	449969.8	0.9962	6	4078.9	0.01038	0.00069	75.2	20.4
4	72	442388.6	0.99614	16	4767.8	0.01422	0.00658	131.4	53.7
5	93	442938.6	0.99585	45.7	5760.4	0.02224	0.00615	266.8	154.5
6	91	445670.6	0.9946	86.6	6365.5	0.03027	0.00402	428.7	294.1
7	99	446104.7	0.99918	148.5	6762	0.04052	0.00368	661.9	504.2
8	103	446606.6	0.99896	221.6	7131.9	0.05175	0.00329	920.7	751.9
9	87	450870.4	0.99759	301.3	7386.5	0.06325	-0.00001	1204.6	1026.1
10	87	437204.7	0.99667	394	7565.1	0.07589	0.01065	1513.7	1319.2
11	83	432880.3	0.99469	483.2	7722.7	0.08843	0.01407	1821.3	1615.8
12	89	431872.9	0.99006	582.3	7915.1	0.10159	0.01487	2167.3	1952.9
13	82	426869.9	0.99419	678.2	7921	0.11382	0.01886	2492.5	2268.4
14	89	428870	0.98617	779.3	8155.5	0.12692	0.01726	2851.2	2622.9
15	94	417227.7	0.98788	899.2	8166.9	0.14167	0.02664	3234.7	2992.6
16	105	421791.5	0.99007	1018.3	8333.9	0.15683	0.02294	3668.5	3425.5
17	103	414568.4	0.99236	1143.8	8335	0.17178	0.0288	4077.8	3825.2
18	107	405490.3	0.99461	1262.4	8341.5	0.18621	0.03626	4453.2	4189.4
19	98	394518.9	0.98626	1379.2	8410.1	0.2006	0.04542	4809.9	4533.8
20	95	400570.2	0.9901	1484.9	8571.2	0.21373	0.04035	5226.2	4948.1
21	100	395745.3	0.99077	1624.6	8626.6	0.22976	0.04439	5692.6	5407.1
22	98	388123.6	0.98881	1751.1	8648	0.24471	0.05084	6089.4	5795.6
23	91	383633.9	0.97865	1878.9	8691.1	0.25992	0.05468	6510.1	6214
24	107	374163.2	0.9854	2017.6	8697	0.27619	0.06286	6934.8	6623.3
25	95	365534.3	0.98233	2138.8	8639.9	0.29074	0.07044	7292.1	6974.8
26	96	364165.5	0.9867	2253.8	8632.7	0.30445	0.07165	7700.4	7380.9
27	90	355172.6	0.9767	2369	8575.6	0.31777	0.07968	8024.3	7698.6
28	93	348233.8	0.98395	2485.5	8515.4	0.33176	0.08597	8374.5	8043.7
29	94	343418.5	0.98255	2596.5	8507.7	0.34521	0.09038	8728.9	8394.7
30	92	336046.1	0.98041	2714.1	8441.4	0.35938	0.09721	9075.2	8733.3
31	92	331019.8	0.98062	2805.8	8371.1	0.3705	0.10191	9348.8	9006.1
32	90	326302.4	0.98008	2922.6	8347.2	0.38473	0.10637	9724.8	9378.1
33	88	319458	0.98143	3036	8293.2	0.39858	0.11291	10054.6	9700.4

Table B1 Tabulated J-R Curve Results for Specimen GPQ-38

UNL #	# DP	COD STIFFNESS lbs/in	CORR COEFF	AREA pl in-lbs	LOAD lbs	COD in	DELTA a in	J E813 in-lbs/sq in	J pl in-lbs/sq in
1	62	446430.5	0.99915	0.1	2370.6	0.00505	0.00343	21	0.3
2	75	448288.3	0.99986	0	3030.9	0.00653	0.00199	32.9	0.1
3	62	449969.8	0.9962	6	4078.9	0.01038	0.00069	75.2	20.4
4	72	442388.6	0.99614	16	4767.8	0.01422	0.00658	131.4	53.7
5	93	442938.6	0.99585	45.7	5760.4	0.02224	0.00615	266.8	154.5
6	91	445670.6	0.9946	86.6	6365.5	0.03027	0.00402	428.7	294.1
7	99	446104.7	0.99918	148.5	6762	0.04052	0.00368	661.9	504.2
8	103	446606.6	0.99896	221.6	7131.9	0.05175	0.00329	920.7	751.9
9	87	450870.4	0.99759	301.3	7386.5	0.06325	-0.00001	1204.6	1026.1
10	87	437204.7	0.99667	394	7565.1	0.07589	0.01065	1513.7	1319.2
11	83	432880.3	0.99469	483.2	7722.7	0.08843	0.01407	1821.3	1615.8
12	89	431872.9	0.99006	582.3	7915.1	0.10159	0.01487	2167.3	1952.9
13	82	426869.9	0.99419	678.2	7921	0.11382	0.01886	2492.5	2268.4
14	89	428870	0.98617	779.3	8155.5	0.12692	0.01726	2851.2	2622.9
15	94	417227.7	0.98788	899.2	8166.9	0.14167	0.02664	3234.7	2992.6
16	105	421791.5	0.99007	1018.3	8333.9	0.15683	0.02294	3668.5	3425.5
17	103	414568.4	0.99236	1143.8	8335	0.17178	0.0288	4077.8	3825.2
18	107	405490.3	0.99461	1262.4	8341.5	0.18621	0.03626	4453.2	4189.4
19	98	394518.9	0.98626	1379.2	8410.1	0.2006	0.04542	4809.9	4533.8
20	95	400570.2	0.9901	1484.9	8571.2	0.21373	0.04035	5226.2	4948.1
21	100	395745.3	0.99077	1624.6	8626.6	0.22976	0.04439	5692.6	5407.1
22	98	388123.6	0.98881	1751.1	8648	0.24471	0.05084	6089.4	5795.6
23	91	383633.9	0.97865	1878.9	8691.1	0.25992	0.05468	6510.1	6214
24	107	374163.2	0.9854	2017.6	8697	0.27619	0.06286	6934.8	6623.3
25	95	365534.3	0.98233	2138.8	8639.9	0.29074	0.07044	7292.1	6974.8
26	96	364165.5	0.9867	2253.8	8632.7	0.30445	0.07165	7700.4	7380.9
27	90	355172.6	0.9767	2369	8575.6	0.31777	0.07968	8024.3	7698.6
28	93	348233.8	0.98395	2485.5	8515.4	0.33176	0.08597	8374.5	8043.7
29	94	343418.5	0.98255	2596.5	8507.7	0.34521	0.09038	8728.9	8394.7
30	92	336046.1	0.98041	2714.1	8441.4	0.35938	0.09721	9075.2	8733.3
31	92	331019.8	0.98062	2805.8	8371.1	0.3705	0.10191	9348.8	9006.1
32	90	326302.4	0.98008	2922.6	8347.2	0.38473	0.10637	9724.8	9378.1
33	88	319458	0.98143	3036	8293.2	0.39858	0.11291	10054.6	9700.4

Table B2 Tabulated J-R Curve Results for Specimen GPQ-39

UNL #	# DP	COD STIFFNESS lbs/in	CORR COEFF	AREA pl in-lbs	LOAD lbs	COD in	DELTA a in	J E813 in-lbs/sq in	J pl in-lbs/sq in
1	96	212958.9	0.9994	0	785.7	0.00228	-0.00057	17.6	-0.6
2	77	210336.7	0.99993	0.5	1188.7	0.00478	0.00154	49.8	6.4
3	66	207135.3	0.99592	3.1	1584.7	0.00851	0.00414	122.8	42.3
4	70	207248.4	0.99977	9.3	1856	0.01348	0.00405	235.1	129.9
5	62	206640.7	0.99962	19	1991.7	0.01905	0.00454	385.2	263.9
6	72	205389	0.99975	32.1	2078.2	0.02586	0.00557	579.1	446.3
7	70	204378.7	0.99963	46.6	2144.7	0.03296	0.0064	788.1	646.4
8	67	202758.3	0.99949	63.9	2197.3	0.04115	0.00774	1038	885.7
9	53	199610.6	0.996	80.6	2231.5	0.04882	0.01035	1269.5	1112.1
10	67	197239.7	0.99587	99.1	2279.4	0.05737	0.01234	1531.6	1366.4
11	68	198598.9	0.99928	119.4	2305.4	0.06638	0.0112	1829.8	1660.1
12	60	195100.5	0.99893	141.1	2315.1	0.07555	0.01415	2126.8	1949.5
13	69	190149.1	0.99539	160.4	2342.1	0.0841	0.01839	2380.1	2196.2
14	73	189112.2	0.99459	180.3	2365	0.09291	0.01928	2666.1	2476.6
15	74	187825.9	0.99604	201.9	2377.4	0.10202	0.0204	2970.9	2777.7
16	77	188092.8	0.99506	222.3	2390.5	0.11069	0.02017	3269.8	3075.7
17	78	184139.7	0.99603	246.5	2399	0.12074	0.02362	3587.7	3387.8
18	86	178519.2	0.99658	270	2397.4	0.1307	0.02862	3880.5	3670.2
19	78	181160.1	0.99501	292.9	2414	0.14062	0.02626	4248.4	4039.3
20	64	177722	0.99266	316.1	2440.6	0.15007	0.02933	4554.1	4335.8
21	69	177391.6	0.99458	336.1	2446.7	0.15853	0.02963	4847.6	4628.1
22	68	172677.3	0.99542	357.5	2449.9	0.16721	0.03392	5105.8	4873.2
23	66	170530.2	0.99343	379.1	2465.4	0.17641	0.03589	5395.5	5162.7
24	71	168306.2	0.99201	402.2	2459.4	0.18586	0.03795	5710.5	5472.3
25	69	167699.7	0.99756	424.5	2468.7	0.19507	0.03852	6041.3	5797.9
26	71	167475.8	0.9974	442.8	2481.3	0.20254	0.03873	6315.6	6070
27	80	164692.3	0.99474	469.4	2493	0.21327	0.04134	6666.4	6416.4

Table B3 Tabulated J-R Curve Results for Specimen GPQ-3

UNL #	# DP	COD STIFFNESS lbs/in	CORR COEFF	AREA pl in-lbs	LOAD lbs	COD in	DELTA a in	J E813 in-lbs/sq in	J pl in-lbs/sq in
1	80	220048.7	0.99993	0	804.9	0.00329	-0.0062	18.1	-0.6
2	82	212396	0.99858	1.6	1273.6	0.00695	-0.00012	68.9	21.5
3	79	212428.7	0.99782	5.6	1523.3	0.01113	-0.00015	145.5	76.9
4	75	211689.7	0.99505	13.4	1670.4	0.01654	0.00045	268.5	183.7
5	76	209979.6	0.99966	25	1797.5	0.02371	0.00183	440	343.2
6	72	208340.5	0.99951	39	1888.1	0.03167	0.00316	643.8	535.5
7	72	206726.2	0.99776	53.5	1964.2	0.03957	0.00447	850	735.1
8	76	205592.1	0.99689	69.3	2014.1	0.04774	0.0054	1074.7	952.8
9	60	202816.4	0.99629	86.7	2049.9	0.05642	0.00769	1317	1188.1
10	71	200706.8	0.99586	105.3	2099.3	0.06567	0.00944	1578.5	1442.6
11	76	200603	0.99932	124.3	2135.3	0.0748	0.00953	1854.3	1709.7
12	70	199251.7	0.99918	143.6	2169.5	0.08381	0.01065	2124.1	1974.8
13	71	197503.8	0.99898	166.3	2213.9	0.09437	0.01212	2442.6	2286.9
14	81	196776.2	0.99665	187.6	2250.6	0.10409	0.01273	2745.3	2584.2
15	62	190772.3	0.99475	209.5	2269.2	0.11376	0.01785	3018.9	2848.2
16	93	191387.9	0.99951	231.2	2302	0.1237	0.01732	3342.6	3166.3
17	94	188933.2	0.99946	258.7	2332.7	0.13555	0.01944	3721.2	3537.5
18	81	185756.5	0.99914	285.1	2340.8	0.14688	0.0222	4075.9	3884.8
19	87	183378.7	0.99945	310.2	2368.9	0.15776	0.02429	4418.4	4221
20	77	180979.3	0.99896	335.8	2381.5	0.16866	0.02642	4767.4	4563.5
21	80	177741.8	0.99892	361	2388.9	0.1793	0.02932	5098	4887.5
22	80	176286.2	0.9983	381.9	2426.2	0.18833	0.03063	5389.5	5173
23	78	173320.8	0.99824	404.1	2420.8	0.19752	0.03333	5676.1	5453.2
24	81	171143.6	0.99659	426.3	2428.9	0.2069	0.03533	5972	5746.7
25	77	166490	0.99565	446	2421.9	0.21514	0.03965	6185.8	5953.7

Table B4 Tabulated J-R Curve Results for Specimen GPQ-12

UNL #	# DP	COD STIFFNESS lbs/in	CORR COEFF	AREA pl in-lbs	LOAD lbs	COD in	DELTA a in	J E813 in-lbs/sq in	J pl in-lbs/sq in
1	55	233766.3	0.9987	0	618.9	0.00215	-0.01675	10.5	-0.2
2	55	217320.9	0.99941	0.2	950.4	0.00397	-0.00405	29.6	3.1
3	57	211498.5	0.99847	0.6	1211.1	0.00578	0.0006	53.4	8.1
4	70	209876.7	0.99615	2.2	1426.4	0.00812	0.00191	94.6	30.2
5	82	211038.4	0.99987	6.7	1701.4	0.01227	0.00097	178.9	92.6
6	75	209191.8	0.99981	15.3	1858.9	0.01767	0.00246	315.1	210.3
7	74	207511.8	0.99981	26.3	1967.6	0.02394	0.00383	480.7	363
8	80	206724.4	0.99972	38.4	2036.8	0.03028	0.00447	655.6	530.1
9	82	204765.3	0.99969	56.3	2101.9	0.03912	0.00608	911.8	776.3
10	80	201143.3	0.9973	73.2	2159.8	0.04732	0.00908	1148.8	1004.1
11	81	199791.7	0.99766	90.5	2206.4	0.0556	0.0102	1400.6	1244.6
12	83	199754.9	0.99958	108	2236.8	0.0636	0.01023	1649.5	1491.7
13	81	199198.7	0.99945	125.9	2270.6	0.0716	0.0107	1905	1741.5
14	80	197657.1	0.9995	144.3	2293.3	0.07971	0.01199	2166.3	1995.1
15	72	195390.7	0.99916	162.8	2318.6	0.08779	0.01391	2419.4	2243.5
16	74	193834.3	0.99894	180.2	2345.6	0.09545	0.01523	2664.3	2482.2
17	77	192376.9	0.99893	199.1	2381.9	0.10362	0.01647	2929.3	2741.5
18	62	191947.2	0.99791	216.8	2402.6	0.11111	0.01684	3183.8	2991
19	76	189146.1	0.99833	235.7	2427	0.119	0.01925	3435.9	3237.1
20	70	190007.1	0.99366	253.2	2456.9	0.12648	0.01851	3699.4	3498.8
21	76	188465.5	0.99423	272.2	2482	0.1342	0.01984	3961.9	3756.2
22	75	186693.8	0.99635	292.6	2484.2	0.1425	0.02138	4242.8	4031.9
23	81	185121.6	0.99674	313.6	2512.7	0.15111	0.02276	4534.3	4316.3
24	86	180969	0.99638	335.1	2539.5	0.15982	0.02643	4801.6	4573.8
25	86	180450.9	0.99656	354.1	2539	0.16764	0.02689	5076.2	4845.7
26	85	174393.4	0.99648	377.7	2547.3	0.17694	0.03235	5341.9	5098.6
27	86	176063.1	0.99894	396.3	2574.3	0.18477	0.03083	5647	5403.3
28	79	173244.9	0.99828	413.7	2561.5	0.19134	0.0334	5862.5	5612.1
29	81	171309.7	0.99893	432.2	2551.4	0.1987	0.03517	6106	5854.2

Table B5 Tabulated J-R Curve Results for Specimen GPQ-18

UNL #	# DP	COD STIFFNESS lbs/in	CORR COEFF	AREA pl in-lbs	LOAD lbs	COD in	DELTA a in	J E813 in-lbs/sq in	J pl in-lbs/sq in
1	111	228659.2	0.999	0	683.2	0.00244	-0.01087	12.5	-0.8
2	117	217125.7	0.99994	0.6	1116.1	0.005	-0.00189	44.2	8.4
3	115	214876.3	0.99847	2.1	1433	0.00784	-0.00011	88.8	28.8
4	77	213923.1	0.99862	3.7	1586.9	0.0097	0.00065	123.9	50.8
5	84	212867.4	0.99765	7.3	1762.5	0.01268	0.0015	189	99.8
6	64	213678.8	0.99741	10.4	1858.6	0.01487	0.00085	241.6	142.6
7	65	213768.1	0.99642	17.5	1969.5	0.01909	0.00078	351	240.5
8	58	210205.7	0.99499	26.2	2035.9	0.02369	0.00364	479.8	357.3
9	70	213712.2	0.99737	37.1	2119.6	0.02947	0.00082	640	512.3
10	60	205646	0.99297	50.1	2156.7	0.03552	0.00736	818.6	678.9
11	65	207005.4	0.99959	63	2186	0.04191	0.00624	1007.2	862.2
12	61	206355	0.99941	78.8	2227.4	0.0491	0.00678	1233	1081.2
13	64	202271.7	0.99656	96.1	2272	0.0569	0.01014	1469.4	1309.1
14	55	200421.3	0.99486	111.7	2303.7	0.06401	0.01168	1688.1	1521.4
15	64	200674.6	0.99625	129.5	2331.1	0.07183	0.01147	1943.6	1773.5
16	61	199234	0.99466	148	2368.4	0.07983	0.01267	2203.8	2028
17	64	200339.5	0.9991	168.6	2383.9	0.0885	0.01175	2505.4	2324.8
18	49	195995.9	0.99391	187.6	2406.1	0.09636	0.01539	2751	2563.7
19	57	193925.8	0.99632	205.8	2428.4	0.10417	0.01715	3002.3	2807.8
20	59	194705.9	0.99574	225.5	2466	0.11244	0.01649	3295.1	3095.7
21	54	192500.6	0.9948	245.8	2498.5	0.12069	0.01837	3569.9	3365.6
22	60	192972.8	0.99413	265.7	2504.3	0.12879	0.01796	3860.8	3655.6
23	60	188511.2	0.99602	285.9	2512.8	0.13679	0.0218	4110.2	3895.9
24	58	189418.3	0.99431	303.6	2525.1	0.14413	0.02102	4376.8	4163
25	67	183437.5	0.99636	327.7	2533.8	0.15356	0.02624	4660.5	4433.9
26	66	181795.8	0.99478	349	2545.7	0.16236	0.02769	4953.8	4723
27	54	182299.2	0.99868	370.9	2547.8	0.17098	0.02725	5285.7	5051.7
28	64	179757.5	0.99929	394.7	2553.9	0.18012	0.02951	5600.1	5359.3
29	74	176966.3	0.99945	418	2557.7	0.18933	0.03202	5899.7	5655.1
30	74	173125.6	0.99906	442.9	2554.1	0.19916	0.03551	6205.7	5954.9
31	84	172221.4	0.99685	456	2574.7	0.20466	0.03633	6388	6133
32	81	169702	0.99708	470.8	2565.2	0.21035	0.03866	6562.4	6303.3

Table B6 Tabulated J-R Curve Results for Specimen GPQ-19

UNL #	# DP	COD STIFFNESS lbs/in	CORR COEFF	AREA pl in-lbs	LOAD lbs	COD in	DELTA a in	J E813 in-lbs/sq in	J pl in-lbs/sq in
1	92	222593.3	0.99983	0	803.5	0.0033	0.00063	18.3	0
2	62	216455.1	0.99985	0.9	1174.5	0.00589	0.00545	52.2	12.5
3	54	214468.4	0.99934	4.8	1521.5	0.01042	0.00703	133.9	65.7
4	60	214422.1	0.99989	10.2	1665.2	0.01446	0.00707	220.8	139.9
5	54	213760.1	0.99965	18.8	1777.8	0.01987	0.0076	350.1	257.4
6	58	212181.5	0.99919	30.3	1866	0.02652	0.00886	516.4	414.9
7	57	212861.1	0.99474	44.5	1950	0.03433	0.00832	721	611.9
8	64	213103	0.99655	58.1	2002.4	0.04137	0.00812	913.8	799.7
9	66	212893.3	0.99626	74.3	2054.2	0.04951	0.00829	1142.7	1022.1
10	63	206334.3	0.99635	91.4	2090.8	0.05787	0.01361	1370.6	1239.4
11	69	206521.7	0.99582	110.2	2144.7	0.06719	0.01345	1637.8	1501.5
12	69	206205	0.99928	128.6	2177.2	0.07577	0.01371	1899.9	1757.2
13	64	204209.7	0.99893	148.4	2211.8	0.08481	0.01535	2173.6	2023.2
14	69	205467.2	0.99844	168	2268.2	0.09386	0.01432	2459.3	2305
15	67	200624.9	0.993	188.8	2300.6	0.10301	0.01832	2727.7	2564.9
16	67	199543.2	0.99831	210.2	2322	0.11251	0.01922	3029.3	2858.6
17	77	201457.7	0.99866	230.3	2366	0.12128	0.01763	3331.1	3158.6
18	69	199860.1	0.99495	252.8	2397.8	0.13066	0.01896	3639	3460.6
19	75	201497.5	0.99604	272.9	2436.3	0.13921	0.01759	3941.3	3760.8
20	62	194270.3	0.99334	298.7	2444.7	0.14966	0.02367	4239.6	4045.7
21	65	195855.1	0.99893	322.1	2457.8	0.15954	0.02233	4595.7	4398
22	61	193825.3	0.99768	348.1	2500.7	0.17002	0.02405	4945.4	4742
23	69	189789.4	0.99731	371.6	2517.2	0.17953	0.02751	5235.1	5022.1
24	74	193588.2	0.99389	393.6	2548.1	0.18856	0.02425	5602.8	5395
25	119	188031.6	0.99828	419.9	2553	0.19862	0.02903	5902.1	5682.4
26	72	186350.8	0.99421	440.2	2560.3	0.20691	0.0305	6169.6	5946.6
27	73	185285.5	0.99426	455	2582.6	0.21286	0.03143	6369.7	6142.8

Table B7 Tabulated J-R Curve Results for Specimen GPQ-26

APPENDIX C - Tabular Fatigue Crack Growth Rate Summary

The following tables contain both intermediate and final calculated quantities plotted in the main text of this report. For each cyclic J specimen a table is presented with the cycle number, the specimen stiffness, the inferred crack length, the correlation, the maximum COD and the applied J range. A second table is then presented for each specimen containing the applied cyclic J, the applied cyclic K, and the estimated crack growth rate over an increment of crack extension. These are tabulations of the results plotted on Figures 31-35 in the main text.

Pmax (lbs)	EvB/P	a (in)	N (X1)	Δa (in)	ΔN (X1)	$\Delta a/\Delta N$ (in/cyc)	ΔK (ksi/in)
	37.10	0.5007	32				
1000	37.81	0.5045	1854	0.0142	7904	1.801E-06	17.82
1000	39.87	0.5150	7935	0.0207	10213	2.023E-06	18.21
1000	42.01	0.5252	12067	0.0209	7144	2.921E-06	18.84
1000	44.41	0.5358	15079	0.0211	5267	4.014E-06	19.49
1000	46.93	0.5463	17334	0.0204	4118	4.952E-06	20.18
1000	49.50	0.5562	19197	0.0197	3456	5.704E-06	20.90
1000	52.22	0.5660	20790	0.0197	3060	6.441E-06	21.64
1000	55.17	0.5759	22257	0.0202	2790	7.227E-06	22.45
1000	58.46	0.5862	23580	0.0202	2392	8.433E-06	23.29
1000	61.90	0.5961	24649	0.0199	2034	9.773E-06	24.21
1000	65.63	0.6061	25614	0.0198	1774	1.117E-05	25.17
1000	69.62	0.6159	26423	0.0196	1554	1.263E-05	26.19
1000	73.92	0.6257	27167	0.0194	1427	1.357E-05	27.27
1000	78.51	0.6353	27850	0.0199	1284	1.549E-05	28.47
1000	83.86	0.6456	28451	0.0207	1128	1.831E-05	29.75
1000	89.80	0.6559	28979	0.0207	969	2.135E-05	31.17
1000	96.28	0.6662	29420	0.0201	785	2.568E-05	32.69
	103.11	0.6761	29763				

Table C1 Tabulated Results for High Cycle Fatigue Specimen GPQ-5

Pmax (lbs)	EvB/P	a (in)	N (X1)	Δa (in)	ΔN (X1)	$\Delta a/\Delta N$ (in/cyc)	ΔK (ksi/in)
	40.17	0.5165	887				
1200	41.97	0.5250	2907	0.0187	4214	4.427E-06	22.64
1200	44.24	0.5351	5101	0.0201	4118	4.873E-06	23.33
1200	46.62	0.5451	7025	0.0200	3599	5.547E-06	24.14
1200	49.19	0.5551	8700	0.0203	3132	6.473E-06	24.99
1200	52.02	0.5653	10157	0.0203	2763	7.354E-06	25.89
1200	55.00	0.5754	11463	0.0209	2410	8.663E-06	26.90
1200	58.46	0.5862	12567	0.0210	1920	1.094E-05	27.94
1200	62.00	0.5964	13383	0.0202	1464	1.381E-05	29.07
1200	65.77	0.6064	14031	0.0202	1208	1.670E-05	30.26
1200	69.90	0.6166	14591	0.0197	1033	1.911E-05	31.49
1200	74.15	0.6262	15064	0.0195	898	2.173E-05	32.83
1200	78.90	0.6361	15489	0.0196	785	2.502E-05	34.22
1200	84.00	0.6458	15849	0.0199	680	2.928E-05	35.77
1200	89.82	0.6560	16169	0.0205	608	3.379E-05	37.44
1200	96.35	0.6664	16457	0.0200	559	3.571E-05	39.22
	103.00	0.6759	16728				

Table C2 Tabulated Results for High Cycle Fatigue Specimen GPQ-15

Table C3 Tabulated Results for Cyclic J Specimen GPQ2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.51213	342007	0.0098	0.99992	22	171.2
2	0.51463	337679	0.0104	0.99990	25	186.3
3	0.51396	338840	0.0107	0.99993	24	188.1
4	0.51307	340374	0.0110	0.99992	25	191.0
5	0.51314	340252	0.0110	0.99992	24	192.7
6	0.51377	339165	0.0111	0.99993	23	195.0
7	0.51374	339211	0.0112	0.99989	25	196.0
8	0.51390	338936	0.0112	0.99995	25	192.8
9	0.51439	338102	0.0114	0.99992	24	200.8
10	0.51366	339350	0.0114	0.99992	24	199.5
11	0.51483	337343	0.0115	0.99991	25	207.2
12	0.51458	337775	0.0115	0.99992	24	201.8
13	0.51540	336367	0.0116	0.99990	25	206.6
14	0.51519	336724	0.0116	0.99994	25	204.8
15	0.51442	338043	0.0118	0.99995	25	208.3
16	0.51509	336897	0.0117	0.99994	25	210.0
17	0.51474	337493	0.0116	0.99994	25	202.9
18	0.51567	335891	0.0117	0.99992	26	208.5
19	0.51504	336977	0.0117	0.99995	26	206.6
20	0.51629	334841	0.0119	0.99991	27	214.6
21	0.51596	335406	0.0119	0.99995	27	215.1
22	0.51652	334436	0.0120	0.99993	27	224.8
23	0.51678	333996	0.0120	0.99994	28	221.2
24	0.51705	333537	0.0120	0.99991	28	220.1
25	0.51796	331998	0.0121	0.99993	29	223.1
26	0.51782	332234	0.0121	0.99993	29	227.0
27	0.51784	332187	0.0121	0.99995	29	219.6
28	0.51800	331918	0.0122	0.99993	29	226.6
29	0.51815	331674	0.0122	0.99995	29	224.5
30	0.51863	330859	0.0123	0.99994	28	223.9
31	0.51841	331234	0.0122	0.99995	29	224.3
32	0.51906	330124	0.0124	0.99995	30	229.1
33	0.51908	330100	0.0123	0.99993	29	228.0
34	0.51900	330224	0.0124	0.99994	29	223.7
35	0.51940	329560	0.0124	0.99993	28	230.0
36	0.51928	329764	0.0124	0.99992	29	227.8
37	0.51966	329122	0.0125	0.99993	29	232.1
38	0.51979	328887	0.0126	0.99993	30	233.5
39	0.52026	328108	0.0125	0.99993	30	232.1
40	0.52069	327382	0.0125	0.99992	29	232.5
41	0.52079	327215	0.0125	0.99994	29	233.1
42	0.52061	327521	0.0127	0.99993	30	235.0
43	0.52116	326588	0.0128	0.99993	31	239.8
44	0.52084	327120	0.0128	0.99992	31	237.4
45	0.52148	326058	0.0129	0.99993	29	239.5
46	0.52178	325554	0.0128	0.99992	30	242.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
47	0.52207	325074	0.0128	0.99997	31	237.5
48	0.52178	325553	0.0129	0.99992	30	244.6
49	0.52230	324676	0.0129	0.99993	30	241.2
50	0.52262	324142	0.0131	0.99993	31	247.6
51	0.52228	324718	0.0131	0.99996	31	249.1
52	0.52303	323466	0.0131	0.99993	31	244.7
53	0.52322	323150	0.0131	0.99994	31	247.4
54	0.52338	322878	0.0131	0.99992	31	246.9
55	0.52368	322391	0.0131	0.99994	31	246.8
56	0.52399	321871	0.0131	0.99995	31	246.8
57	0.52441	321167	0.0133	0.99992	33	257.2
58	0.52430	321356	0.0133	0.99993	33	251.1
59	0.52491	320349	0.0134	0.99992	33	255.7
60	0.52489	320384	0.0135	0.99996	34	259.4
61	0.52570	319036	0.0135	0.99994	33	259.1
62	0.52566	319114	0.0136	0.99994	33	259.4
63	0.52611	318360	0.0136	0.99995	34	257.0
64	0.52639	317905	0.0136	0.99992	34	256.8
65	0.52699	316922	0.0137	0.99991	34	261.2
66	0.52734	316353	0.0137	0.99991	34	261.1
67	0.52752	316058	0.0138	0.99993	34	260.5
68	0.52759	315933	0.0137	0.99993	34	259.9
69	0.52799	315281	0.0139	0.99992	35	272.1
70	0.52835	314691	0.0139	0.99993	34	271.2
71	0.52839	314635	0.0139	0.99993	35	267.1
72	0.52896	313700	0.0140	0.99993	35	269.5
73	0.52894	313739	0.0140	0.99994	34	273.6
74	0.52948	312849	0.0140	0.99995	35	276.6
75	0.52943	312940	0.0141	0.99994	34	275.3
76	0.53025	311599	0.0142	0.99993	35	277.1
77	0.53086	310614	0.0142	0.99992	35	275.5
78	0.53068	310910	0.0144	0.99992	35	287.1
79	0.53109	310243	0.0144	0.99992	35	281.1
80	0.53109	310241	0.0145	0.99992	36	288.0
81	0.53174	309199	0.0145	0.99993	35	281.8
82	0.53205	308691	0.0146	0.99994	35	285.6
83	0.53237	308185	0.0148	0.99992	35	292.2
84	0.53291	307310	0.0148	0.99994	35	290.2
85	0.53274	307580	0.0150	0.99992	36	298.9
86	0.53338	306566	0.0150	0.99992	36	300.3
87	0.53380	305884	0.0150	0.99992	36	298.0
88	0.53425	305170	0.0151	0.99994	35	302.3
89	0.53388	305765	0.0153	0.99988	35	309.2
90	0.53418	305281	0.0154	0.99989	35	307.7
91	0.53458	304637	0.0153	0.99988	35	307.6
92	0.53513	303769	0.0155	0.99989	35	314.8
93	0.53519	303669	0.0155	0.99991	35	313.4
94	0.53605	302307	0.0155	0.99991	35	309.9
95	0.53614	302157	0.0158	0.99989	35	317.6
96	0.53629	301928	0.0157	0.99991	35	321.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
97	0.53691	300948	0.0158	0.99992	35	319.5
98	0.53733	300278	0.0160	0.99992	35	326.2
99	0.53759	299881	0.0161	0.99994	36	327.8
100	0.53741	300162	0.0162	0.99991	36	333.8
101	0.53783	299498	0.0164	0.99990	36	339.9
102	0.53852	298414	0.0164	0.99993	36	337.6
103	0.53799	299238	0.0164	0.99994	35	338.6
104	0.53869	298138	0.0166	0.99990	36	340.8
105	0.53944	296965	0.0167	0.99991	36	350.9
106	0.53992	296215	0.0168	0.99991	36	348.3
107	0.53998	296120	0.0169	0.99989	36	352.6
108	0.54077	294890	0.0170	0.99993	36	356.7
109	0.54142	293875	0.0170	0.99994	35	357.8
110	0.54160	293594	0.0173	0.99989	36	363.0
111	0.54242	292325	0.0173	0.99991	36	369.0
112	0.54253	292158	0.0175	0.99993	36	367.7
113	0.54318	291159	0.0177	0.99991	36	378.1
114	0.54413	289695	0.0177	0.99993	36	376.2
115	0.54418	289622	0.0180	0.99992	35	383.0
116	0.54472	288782	0.0183	0.99991	35	388.7
117	0.54548	287618	0.0183	0.99992	35	389.3
118	0.54595	286901	0.0185	0.99993	35	394.5
119	0.54654	286000	0.0187	0.99991	35	396.8
120	0.54724	284940	0.0189	0.99993	35	401.1
121	0.54800	283784	0.0191	0.99989	35	409.9
122	0.54884	282517	0.0192	0.99990	35	415.3
123	0.54900	282279	0.0194	0.99991	35	422.9
124	0.54978	281104	0.0197	0.99993	35	421.2
125	0.55067	279758	0.0199	0.99990	35	427.4
126	0.55130	278809	0.0201	0.99990	35	430.3
127	0.55138	278690	0.0205	0.99985	36	444.7
128	0.55258	276907	0.0207	0.99988	36	446.3
129	0.55324	275926	0.0211	0.99986	36	451.4
130	0.55407	274690	0.0214	0.99988	36	457.0
131	0.55457	273947	0.0216	0.99991	35	460.3
132	0.55546	272633	0.0220	0.99987	36	472.4
133	0.55651	271089	0.0222	0.99986	36	478.2
134	0.55764	269439	0.0226	0.99987	36	484.3
135	0.55847	268225	0.0230	0.99984	36	491.4
136	0.55950	266725	0.0236	0.99986	35	500.9
137	0.56082	264828	0.0240	0.99987	35	513.3
138	0.56149	263853	0.0244	0.99988	35	514.9
139	0.56278	262004	0.0248	0.99986	35	529.0
140	0.56382	260511	0.0253	0.99985	36	537.0
141	0.56470	259254	0.0260	0.99983	36	544.4
142	0.56533	258363	0.0268	0.99984	35	557.3
143	0.56757	255195	0.0276	0.99979	36	571.3
144	0.56858	253783	0.0286	0.99984	35	586.0
145	0.57017	251555	0.0298	0.99981	35	601.2
146	0.57194	249100	0.0311	0.99983	35	615.7

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
147	0.57433	245809	0.0328	0.99983	35	632.5
148	0.57623	243210	0.0351	0.99980	35	637.3
149	0.57765	241275	0.0377	0.99979	35	640.3
150	0.58041	237562	0.0419	0.99983	35	652.2
151	0.58294	234183	0.0460	0.99979	35	661.7
152	0.58678	229115	0.0500	0.99984	35	678.0
153	0.58983	225147	0.0542	0.99982	35	687.3
154	0.59362	220286	0.0582	0.99980	35	702.0
155	0.59831	214355	0.0624	0.99981	35	716.7
156	0.60328	208192	0.0665	0.99976	35	734.1
157	0.60833	202045	0.0707	0.99983	35	751.2
158	0.61367	195671	0.0750	0.99979	35	766.8
159	0.61891	189539	0.0791	0.99979	35	786.2
160	0.62421	183477	0.0833	0.99978	34	805.8
161	0.63265	174062	0.0874	0.99980	33	834.6
162	0.64194	164065	0.0916	0.99982	32	870.2
163	0.65148	154165	0.0958	0.99975	32	906.6
164	0.66290	142814	0.1000	0.99978	31	959.1
165	0.67550	130898	0.1040	0.99981	31	1021.7
166	0.68667	120847	0.1081	0.99976	31	1097.6
167	0.70056	109007	0.1121	0.99979	31	1184.0
168	0.71487	97559	0.1163	0.99974	32	1302.7
169	0.73341	83817	0.1205	0.99981	31	1472.2
170	0.75162	71484	0.1245	0.99970	32	1708.4
171	0.76858	61000	0.1287	0.99976	32	1988.5
172	0.78514	51673	0.1328	0.99976	34	2366.8
173	0.80279	42692	0.1368	0.99968	36	2858.1
174	0.81753	35932	0.1410	0.99969	37	3449.5
175	0.83030	30605	0.1451	0.99970	37	4155.6
176	0.84170	26261	0.1493	0.99960	38	4973.6
177	0.85404	21975	0.1534	0.99969	38	6131.6
178	0.86641	18108	0.1576	0.99963	39	7775.1

Table C4 Crack Growth Rate Results - Specimen GPQ2

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
174.0	73170	0.00026
183.6	75161	0.00020
175.7	73527	0.00021
175.9	73568	0.00021
181.5	74730	0.00029
184.1	75264	0.00034
186.5	75753	0.00026
195.7	77599	0.00032
201.1	78662	0.00031
202.8	78994	0.00030
199.2	78289	0.00035
208.6	80115	0.00035
214.2	81184	0.00046
229.4	84015	0.00045
229.7	84070	0.00058
235.2	85070	0.00065
243.5	86558	0.00062
250.0	87706	0.00063
257.9	89081	0.00082
271.9	91467	0.00074
286.1	93825	0.00105
291.8	94755	0.00095
312.6	98074	0.00100
333.4	101284	0.00115
341.0	102432	0.00075
360.2	105276	0.00230
380.2	108159	0.00130
414.7	112960	0.00170
458.1	118724	0.00240
481.0	121655	0.00190
543.5	129318	0.00150
566.8	132061	0.00270
604.2	136348	0.00250
633.3	139593	0.00390
660.5	142559	0.00300
664.1	142947	0.00380
689.4	145644	0.00470
698.1	146561	0.00500
712.3	148044	0.00500
720.9	148935	0.00540
747.0	151607	0.00520
804.4	157324	0.00530
817.4	158590	0.00850
862.0	162859	0.00920
871.1	163716	0.00960

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
893.7	165827	0.01140
906.7	167028	0.01260
927.1	168897	0.01120
930.4	169197	0.01390
923.4	168560	0.01430
909.1	167249	0.01850
880.9	164635	0.01820
825.3	159354	0.01700
753.1	152225	0.01650
652.6	141704	0.01770
632.9	139549	0.01470
604.4	136371	0.01280
598.4	135692	0.01140
556.6	130867	0.01230

Table C5 Tabulated Results for Cyclic J Specimen GPQ7

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.50318	357815	0.0113	0.99924	19	171.8
2	0.50374	356802	0.0118	0.99919	20	182.4
3	0.50555	353576	0.0123	0.99966	20	189.4
4	0.50435	355722	0.0125	0.99956	20	197.3
5	0.50527	354077	0.0125	0.99968	20	188.7
6	0.50554	353588	0.0126	0.99971	20	188.0
7	0.50554	353595	0.0126	0.99963	20	199.0
8	0.50596	352836	0.0127	0.99975	20	199.6
9	0.50568	353349	0.0128	0.99969	21	194.1
10	0.50664	351633	0.0129	0.99976	21	198.6
11	0.50580	353121	0.0129	0.99977	21	199.6
12	0.50657	351763	0.0130	0.99979	21	199.1
13	0.50652	351848	0.0131	0.99976	21	202.5
14	0.50687	351235	0.0132	0.99976	21	204.7
15	0.50668	351561	0.0131	0.99977	21	197.8
16	0.50702	350963	0.0132	0.99979	21	203.5
17	0.50758	349963	0.0133	0.99975	22	207.8
18	0.50774	349681	0.0132	0.99985	21	206.7
19	0.50759	349960	0.0133	0.99982	21	207.8
20	0.50817	348934	0.0134	0.99981	22	213.8
21	0.50849	348372	0.0133	0.99980	22	206.5
22	0.50806	349132	0.0134	0.99974	21	208.3
23	0.50878	347854	0.0135	0.99981	22	208.7
24	0.50874	347922	0.0134	0.99982	21	211.2
25	0.50893	347598	0.0136	0.99975	22	215.6
26	0.50971	346217	0.0135	0.99985	21	215.1
27	0.50995	345796	0.0136	0.99984	21	215.7
28	0.50981	346056	0.0136	0.99979	22	212.8
29	0.50992	345857	0.0136	0.99984	22	214.8
30	0.51052	344800	0.0137	0.99982	23	219.1
31	0.51046	344907	0.0138	0.99976	24	222.1
32	0.51131	343420	0.0139	0.99981	23	220.6
33	0.51159	342949	0.0139	0.99982	24	225.9
34	0.51182	342547	0.0139	0.99983	24	224.5
35	0.51222	341843	0.0139	0.99982	24	223.0
36	0.51227	341755	0.0140	0.99985	23	227.5
37	0.51267	341070	0.0141	0.99984	23	225.0
38	0.51309	340343	0.0141	0.99984	22	226.3
39	0.51324	340085	0.0142	0.99983	23	228.2
40	0.51369	339308	0.0142	0.99985	23	230.4
41	0.51362	339428	0.0143	0.99979	23	234.2
42	0.51419	338443	0.0144	0.99981	24	233.6
43	0.51403	338722	0.0143	0.99980	23	233.7
44	0.51467	337620	0.0144	0.99982	24	237.0
45	0.51511	336865	0.0144	0.99986	24	236.5
46	0.51536	336431	0.0146	0.99982	24	242.4

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
47	0.51523	336643	0.0145	0.99986	24	240.3
48	0.51624	334919	0.0147	0.99987	24	248.0
49	0.51606	335236	0.0148	0.99984	25	244.6
50	0.51642	334622	0.0148	0.99983	25	251.5
51	0.51727	333167	0.0149	0.99984	25	250.9
52	0.51764	332531	0.0149	0.99984	25	251.3
53	0.51832	331380	0.0149	0.99985	25	252.3
54	0.51832	331382	0.0151	0.99979	26	260.9
55	0.51848	331103	0.0151	0.99983	25	255.9
56	0.51881	330556	0.0152	0.99986	25	261.8
57	0.51906	330128	0.0153	0.99982	26	260.7
58	0.52011	328348	0.0153	0.99986	25	262.1
59	0.51990	328706	0.0154	0.99982	25	266.6
60	0.52012	328340	0.0154	0.99985	25	266.9
61	0.52081	327182	0.0154	0.99983	25	269.3
62	0.52152	325985	0.0156	0.99985	25	268.9
63	0.52208	325049	0.0158	0.99976	26	279.5
64	0.52240	324523	0.0158	0.99978	26	279.5
65	0.52269	324034	0.0159	0.99977	26	276.9
66	0.52423	321476	0.0160	0.99979	27	285.1
67	0.52429	321373	0.0161	0.99978	27	282.0
68	0.52516	319940	0.0161	0.99982	26	283.1
69	0.52497	320252	0.0162	0.99985	27	286.2
70	0.52517	319911	0.0163	0.99970	26	284.4
71	0.52574	318982	0.0164	0.99974	27	285.8
72	0.52599	318559	0.0164	0.99977	27	290.7
73	0.52668	317436	0.0165	0.99979	27	290.3
74	0.52725	316495	0.0166	0.99969	27	298.0
75	0.52814	315039	0.0167	0.99969	27	302.7
76	0.52895	313716	0.0168	0.99969	27	303.9
77	0.52931	313137	0.0170	0.99969	27	302.0
78	0.53070	310880	0.0171	0.99970	27	310.8
79	0.53027	311574	0.0172	0.99954	28	314.4
80	0.53007	311888	0.0173	0.99961	28	311.5
81	0.53090	310559	0.0175	0.99966	28	318.9
82	0.53098	310425	0.0175	0.99965	28	318.0
83	0.53137	309799	0.0175	0.99976	28	319.6
84	0.53135	309831	0.0177	0.99958	28	323.8
85	0.53210	308621	0.0178	0.99961	28	321.4
86	0.53223	308414	0.0179	0.99957	28	329.0
87	0.53358	306246	0.0179	0.99966	29	326.9
88	0.53338	306564	0.0181	0.99963	29	329.7
89	0.53338	306560	0.0182	0.99956	28	334.5
90	0.53548	303215	0.0183	0.99964	29	335.2
91	0.53511	303805	0.0185	0.99957	28	340.6
92	0.53596	302447	0.0185	0.99968	29	337.8
93	0.53656	301497	0.0186	0.99960	29	342.2
94	0.53759	299872	0.0187	0.99964	29	349.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
95	0.53734	300269	0.0190	0.99950	29	351.2
96	0.53853	298389	0.0190	0.99964	29	350.3
97	0.53845	298522	0.0192	0.99949	29	353.4
98	0.53876	298036	0.0194	0.99956	29	360.0
99	0.54006	296001	0.0195	0.99955	28	367.0
100	0.54005	296021	0.0197	0.99945	29	368.4
101	0.54064	295099	0.0199	0.99942	29	372.5
102	0.54159	293624	0.0200	0.99957	29	371.0
103	0.54208	292849	0.0202	0.99935	30	374.7
104	0.54278	291766	0.0204	0.99937	30	386.1
105	0.54354	290593	0.0206	0.99942	29	384.0
106	0.54398	289921	0.0209	0.99932	29	392.5
107	0.54599	286841	0.0210	0.99949	30	399.3
108	0.54630	286368	0.0212	0.99941	30	402.4
109	0.54758	284427	0.0215	0.99932	30	403.0
110	0.54796	283839	0.0218	0.99930	29	413.0
111	0.54840	283180	0.0221	0.99917	29	414.6
112	0.54981	281057	0.0222	0.99946	30	421.9
113	0.55027	280358	0.0226	0.99924	29	425.4
114	0.55087	279462	0.0228	0.99925	29	428.1
115	0.55197	277818	0.0232	0.99910	30	437.1
116	0.55274	276660	0.0235	0.99915	30	440.8
117	0.55373	275196	0.0239	0.99906	30	448.5
118	0.55509	273185	0.0242	0.99913	30	459.0
119	0.55623	271513	0.0246	0.99904	30	461.6
120	0.55646	271166	0.0250	0.99901	30	468.4
121	0.55790	269054	0.0254	0.99892	30	477.4
122	0.55869	267910	0.0259	0.99899	30	478.9
123	0.56080	264849	0.0263	0.99906	31	490.6
124	0.56115	264350	0.0267	0.99893	31	499.1
125	0.56274	262065	0.0273	0.99898	31	505.4
126	0.56400	260259	0.0279	0.99868	31	516.3
127	0.56535	258332	0.0287	0.99880	31	523.9
128	0.56685	256216	0.0297	0.99881	31	539.7
129	0.56941	252619	0.0308	0.99875	31	551.7
130	0.57069	250831	0.0321	0.99883	31	566.9
131	0.57388	246425	0.0356	0.99893	31	599.9
132	0.57609	243395	0.0373	0.99895	32	623.9
133	0.57837	240310	0.0397	0.99892	32	644.4
134	0.58141	236224	0.0437	0.99907	32	657.2
135	0.58665	229293	0.0478	0.99898	33	679.5
136	0.59117	223424	0.0519	0.99908	33	694.2
137	0.59686	216171	0.0560	0.99903	33	711.6
138	0.60263	208993	0.0601	0.99904	33	731.0
139	0.60864	201673	0.0642	0.99895	33	753.2
140	0.61629	192590	0.0684	0.99903	33	783.4
141	0.62201	185983	0.0724	0.99896	33	804.3
142	0.63025	176705	0.0765	0.99903	33	839.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
143	0.63876	167440	0.0807	0.99887	33	880.0
144	0.65039	155279	0.0847	0.99883	32	932.6
145	0.66056	145103	0.0889	0.99876	30	984.9
146	0.67501	131349	0.0930	0.99865	28	1060.5
147	0.68403	123176	0.0972	0.99853	27	1115.7
148	0.69431	114245	0.1014	0.99804	24	1186.3
149	0.70699	103776	0.1056	0.99788	22	1288.6
150	0.71996	93666	0.1097	0.99664	18	1390.8
151	0.72604	89138	0.1138	0.99303	13	1409.9
152	0.72275	91572	0.1179	0.97574	8	1281.4

Table C6 Crack Growth Rate Results - Specimen GPQ7

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
198.3	78112	0.00019
181.2	74668	0.00021
188.1	76077	0.00031
204.0	79227	0.00032
193.2	77101	0.00027
198.2	78093	0.00037
195.3	77519	0.00037
191.8	76821	0.00041
199.8	78407	0.00046
221.4	82537	0.00062
212.1	80785	0.00052
211.3	80632	0.00084
234.1	84871	0.00040
231.5	84398	0.00038
231.4	84380	0.00061
245.7	86948	0.00060
248.6	87460	0.00035
260.2	89477	0.00061
269.5	91062	0.00068
272.2	91517	0.00199
284.2	93513	0.00175
292.9	94933	0.00095
313.8	98262	0.00057
323.8	99815	0.00089
327.7	100415	0.00140
336.2	101708	0.00070
343.4	102792	0.00140
351.5	103997	0.00080
352.2	104101	0.00210
370.0	106699	0.00030
373.5	107202	0.00160
390.0	109545	0.00130
410.6	112400	0.00140
428.8	114864	0.00140
452.1	117944	0.00260
522.7	126819	0.00130
538.5	128722	0.00320
576.6	133197	0.00220
652.1	141650	0.00230
686.5	145338	0.00300
715.8	148407	0.00520
748.4	151749	0.00460
771.8	154103	0.00570
801.9	157079	0.00570
880.2	164569	0.00600

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
924.2	168633	0.00770
963.1	172145	0.00570
1023.9	177495	0.00830
1065.5	181065	0.00850
1110.3	184833	0.01160
1136.1	186968	0.01020
1188.4	191223	0.01440
1216.8	193494	0.00900
1237.7	195149	0.01030
1251.2	196210	0.01270
1273.4	197943	0.01300
1237.1	195102	0.00600

Table C7 Tabulated Results for Cyclic J Specimen GPQ16

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.51730	333112	0.0086	0.99997	14	138.8
2	0.51602	335297	0.0087	0.99995	18	173.7
3	0.51539	336376	0.0090	0.99994	18	153.3
4	0.51511	336858	0.0091	0.99993	18	187.5
5	0.51563	335970	0.0095	0.99989	18	183.6
6	0.51614	335090	0.0096	0.99994	18	183.6
7	0.51618	335031	0.0097	0.99993	18	184.8
8	0.51645	334559	0.0097	0.99992	18	184.4
9	0.51630	334813	0.0099	0.99992	19	183.3
10	0.51624	334915	0.0100	0.99992	19	163.1
11	0.51578	335714	0.0101	0.99991	19	196.6
12	0.51685	333876	0.0101	0.99990	20	197.2
13	0.51698	333654	0.0102	0.99991	19	201.5
14	0.51734	333046	0.0104	0.99993	20	174.3
15	0.51671	334114	0.0106	0.99996	19	188.7
16	0.51737	332989	0.0108	0.99992	20	180.3
17	0.51672	334106	0.0109	0.99993	20	196.8
18	0.51688	333834	0.0110	0.99992	19	203.3
19	0.51700	333623	0.0110	0.99994	19	200.6
20	0.51708	333485	0.0110	0.99995	20	185.8
21	0.51752	332738	0.0112	0.99993	20	189.5
22	0.51788	332120	0.0112	0.99997	19	200.9
23	0.51727	333160	0.0114	0.99990	20	205.5
24	0.51783	332214	0.0114	0.99995	21	194.9
25	0.51742	332906	0.0115	0.99992	20	197.9
26	0.51739	332960	0.0116	0.99991	20	202.9
27	0.51734	333038	0.0116	0.99990	21	201.3
28	0.51729	333138	0.0118	0.99992	21	205.2
29	0.51759	332612	0.0118	0.99989	21	203.4
30	0.51726	333188	0.0119	0.99991	21	205.1
31	0.51728	333142	0.0120	0.99993	21	210.6
32	0.51765	332517	0.0121	0.99992	21	209.4
33	0.51741	332924	0.0121	0.99994	21	211.3
34	0.51667	334187	0.0123	0.99985	22	213.8
35	0.51672	334104	0.0123	0.99987	21	214.6
36	0.51682	333930	0.0124	0.99979	22	219.0
37	0.51764	332542	0.0124	0.99984	22	220.1
38	0.51709	333470	0.0125	0.99979	22	224.7
39	0.51788	332126	0.0125	0.99975	22	219.5
40	0.51837	331299	0.0127	0.99976	23	227.3
41	0.51827	331463	0.0126	0.99976	22	224.6
42	0.51767	332492	0.0128	0.99977	22	228.8
43	0.51793	332041	0.0128	0.99979	22	230.8
44	0.51921	329877	0.0128	0.99981	23	230.4
45	0.51842	331216	0.0130	0.99979	23	234.6
46	0.51805	331843	0.0131	0.99982	23	233.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
47	0.51955	329307	0.0132	0.99983	24	243.4
48	0.51920	329896	0.0132	0.99985	23	234.1
49	0.51931	329700	0.0133	0.99982	24	239.3
50	0.52027	328083	0.0132	0.99983	24	243.2
51	0.52014	328298	0.0134	0.99983	24	239.6
52	0.52001	328532	0.0135	0.99986	24	245.9
53	0.51953	329339	0.0135	0.99984	24	244.1
54	0.52052	327673	0.0136	0.99989	24	246.4
55	0.52078	327234	0.0142	0.99988	24	273.6
56	0.52065	327440	0.0144	0.99991	23	262.6
57	0.52088	327057	0.0146	0.99995	23	271.2
58	0.52051	327683	0.0147	0.99993	23	270.4
59	0.52058	327562	0.0146	0.99996	24	271.6
60	0.52050	327704	0.0146	0.99993	24	269.8
61	0.52094	326966	0.0146	0.99994	24	269.9
62	0.52111	326667	0.0148	0.99993	24	274.7
63	0.52132	326328	0.0149	0.99995	24	276.7
64	0.52107	326735	0.0149	0.99996	25	279.8
65	0.52140	326196	0.0149	0.99995	24	279.5
66	0.52099	326869	0.0149	0.99995	24	279.7
67	0.52235	324599	0.0150	0.99994	24	284.4
68	0.52202	325156	0.0151	0.99990	24	285.0
69	0.52159	325871	0.0152	0.99998	24	283.1
70	0.52227	324738	0.0151	0.99995	24	282.1
71	0.52218	324881	0.0151	0.99994	24	282.2
72	0.52207	325062	0.0151	0.99995	24	282.5
73	0.52262	324147	0.0151	0.99992	25	281.9
74	0.52301	323502	0.0152	0.99996	25	287.1
75	0.52333	322972	0.0153	0.99996	25	284.1
76	0.52407	321733	0.0154	0.99996	25	288.6
77	0.52475	320607	0.0154	0.99992	25	291.9
78	0.52459	320876	0.0155	0.99992	25	294.6
79	0.52484	320468	0.0156	0.99996	25	291.4
80	0.52496	320260	0.0157	0.99996	25	296.2
81	0.52469	320703	0.0158	0.99995	25	294.3
82	0.52512	319991	0.0158	0.99997	26	299.0
83	0.52571	319031	0.0159	0.99996	26	300.1
84	0.52650	317724	0.0159	0.99994	26	299.1
85	0.52697	316959	0.0160	0.99995	26	304.8
86	0.52715	316651	0.0161	0.99989	26	304.7
87	0.52737	316291	0.0162	0.99990	26	310.1
88	0.52720	316582	0.0163	0.99996	26	307.8
89	0.52765	315835	0.0162	0.99994	26	303.2
90	0.52798	315304	0.0163	0.99994	26	306.7
91	0.52835	314694	0.0164	0.99994	27	307.9
92	0.52815	315014	0.0166	0.99993	26	311.8
93	0.52896	313700	0.0165	0.99993	27	312.3
94	0.52918	313338	0.0168	0.99994	26	317.8

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
95	0.52940	312985	0.0167	0.99994	26	316.3
96	0.52997	312052	0.0167	0.99993	26	316.8
97	0.53038	311393	0.0169	0.99996	26	321.7
98	0.53028	311556	0.0169	0.99993	27	315.5
99	0.53078	310750	0.0171	0.99994	26	325.9
100	0.53113	310183	0.0170	0.99992	27	321.9
101	0.53102	310363	0.0172	0.99993	27	326.1
102	0.53158	309462	0.0173	0.99995	26	330.3
103	0.53152	309548	0.0173	0.99991	27	330.1
104	0.53163	309374	0.0174	0.99992	27	328.7
105	0.53275	307570	0.0175	0.99991	28	334.9
106	0.53291	307307	0.0175	0.99992	27	328.1
107	0.53273	307600	0.0177	0.99992	28	333.0
108	0.53305	307092	0.0179	0.99987	28	337.8
109	0.53436	304994	0.0179	0.99990	28	340.5
110	0.53347	306421	0.0182	0.99990	28	343.0
111	0.53384	305825	0.0181	0.99993	27	343.3
112	0.53448	304802	0.0183	0.99990	28	346.6
113	0.53468	304481	0.0183	0.99993	27	347.4
114	0.53495	304056	0.0183	0.99993	27	345.0
115	0.53540	303338	0.0186	0.99991	28	355.1
116	0.53555	303106	0.0185	0.99994	27	350.0
117	0.53618	302098	0.0188	0.99993	28	360.2
118	0.53600	302394	0.0189	0.99991	28	359.4
119	0.53677	301161	0.0189	0.99991	28	359.6
120	0.53741	300162	0.0190	0.99994	28	360.9
121	0.53721	300472	0.0193	0.99992	28	369.5
122	0.53764	299798	0.0193	0.99991	28	370.2
123	0.53773	299658	0.0193	0.99992	28	368.6
124	0.53806	299138	0.0196	0.99992	28	373.4
125	0.53826	298825	0.0197	0.99993	28	372.3
126	0.53860	298280	0.0198	0.99991	28	372.3
127	0.53909	297517	0.0199	0.99991	29	375.6
128	0.53975	296486	0.0201	0.99989	29	380.8
129	0.53966	296620	0.0202	0.99988	28	381.1
130	0.54022	295742	0.0204	0.99990	28	386.3
131	0.54037	295517	0.0204	0.99992	28	384.6
132	0.54120	294223	0.0207	0.99988	29	388.8
133	0.54085	294760	0.0208	0.99992	28	389.2
134	0.54220	292672	0.0210	0.99991	29	396.3
135	0.54248	292230	0.0210	0.99991	29	393.4
136	0.54305	291354	0.0213	0.99989	29	398.8
137	0.54330	290963	0.0214	0.99991	29	398.4
138	0.54302	291396	0.0215	0.99990	29	400.3
139	0.54357	290554	0.0219	0.99990	29	405.5
140	0.54448	289148	0.0219	0.99992	29	411.7
141	0.54499	288373	0.0221	0.99991	29	411.6
142	0.54548	287629	0.0221	0.99993	29	410.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
143	0.54560	287435	0.0225	0.99990	29	415.4
144	0.54618	286553	0.0228	0.99991	29	419.2
145	0.54665	285838	0.0228	0.99993	29	418.5
146	0.54734	284782	0.0231	0.99990	29	424.4
147	0.54767	284293	0.0231	0.99992	29	422.4
148	0.54845	283110	0.0234	0.99992	29	428.7
149	0.54890	282427	0.0236	0.99991	29	431.9
150	0.54952	281482	0.0240	0.99991	29	437.6
151	0.55037	280213	0.0242	0.99989	29	442.3
152	0.55066	279775	0.0244	0.99990	30	444.3
153	0.55181	278053	0.0247	0.99990	30	449.6
154	0.55202	277738	0.0250	0.99991	30	453.3
155	0.55221	277461	0.0252	0.99989	29	451.8
156	0.55319	275995	0.0257	0.99987	30	461.1
157	0.55399	274816	0.0258	0.99991	30	465.1
158	0.55507	273221	0.0262	0.99990	30	469.8
159	0.55537	272774	0.0266	0.99991	30	471.3
160	0.55618	271582	0.0269	0.99990	30	477.5
161	0.55689	270531	0.0272	0.99991	30	477.0
162	0.55717	270133	0.0277	0.99987	30	483.4
163	0.55829	268485	0.0280	0.99989	30	488.6
164	0.55883	267705	0.0286	0.99987	30	494.8
165	0.55986	266212	0.0289	0.99988	30	499.0
166	0.56042	265401	0.0296	0.99983	31	506.0
167	0.56193	263224	0.0300	0.99989	30	513.7
168	0.56256	262318	0.0308	0.99989	30	519.8
169	0.56374	260632	0.0314	0.99987	30	523.6
170	0.56445	259612	0.0319	0.99986	30	529.3
171	0.56521	258538	0.0325	0.99979	32	533.0
172	0.56666	256486	0.0335	0.99988	30	545.8
173	0.56787	254783	0.0345	0.99989	30	553.1
174	0.56975	252147	0.0351	0.99987	31	562.2
175	0.57042	251203	0.0361	0.99986	31	571.4
176	0.57224	248677	0.0374	0.99986	31	582.8
177	0.57420	245987	0.0393	0.99988	31	597.0
178	0.57594	243600	0.0410	0.99986	31	606.4
179	0.57764	241297	0.0426	0.99986	31	620.2
180	0.57975	238451	0.0437	0.99987	32	635.3
181	0.58142	236212	0.0453	0.99984	33	647.7
182	0.58351	233424	0.0477	0.99984	32	662.1
183	0.58533	231028	0.0495	0.99986	32	674.6
184	0.58730	228445	0.0521	0.99986	32	689.7
185	0.58978	225221	0.0561	0.99986	32	703.3
186	0.59416	219594	0.0602	0.99986	33	721.6
187	0.59891	213609	0.0642	0.99989	33	744.0
188	0.60398	207323	0.0683	0.99985	33	761.5
189	0.60920	200995	0.0724	0.99983	33	785.4
190	0.61616	192738	0.0765	0.99985	34	815.4

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
191	0.62244	185490	0.0807	0.99983	34	844.3
192	0.62899	178108	0.0848	0.99982	34	872.5
193	0.63709	169237	0.0890	0.99986	34	906.3
194	0.64670	159079	0.0931	0.99989	33	947.2
195	0.65708	148534	0.0973	0.99983	32	991.0
196	0.67108	135007	0.1015	0.99976	32	1053.4
197	0.68741	120201	0.1057	0.99972	31	1149.6
198	0.70314	106889	0.1098	0.99970	31	1269.4
199	0.71939	94102	0.1139	0.99972	30	1397.6
200	0.73637	81736	0.1179	0.99969	30	1577.1
201	0.75405	69919	0.1221	0.99973	31	1811.9
202	0.77086	59662	0.1263	0.99968	32	2116.1
203	0.78871	49776	0.1305	0.99975	33	2566.4
204	0.80478	41742	0.1347	0.99960	36	3023.0
205	0.81961	35033	0.1387	0.99958	36	3666.8
206	0.83402	29148	0.1429	0.99959	37	4585.3
207	0.84989	23369	0.1469	0.99944	38	5874.1
208	0.86682	17989	0.1510	0.99944	38	8101.3

Table C8 Crack Growth Rate Results - Specimen GPQ16

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
173.1	72981	0.00006
190.2	76500	0.00013
203.3	79091	0.00016
211.5	80670	0.00027
209.2	80230	0.00030
216.8	81675	0.00028
233.0	84671	0.00030
218.4	81976	0.00027
242.0	86291	0.00028
262.1	89803	0.00032
267.0	90639	0.00031
268.1	90825	0.00033
284.7	93595	0.00047
308.2	97381	0.00045
306.6	97128	0.00045
320.1	99243	0.00057
337.3	101875	0.00067
341.1	102447	0.00063
345.0	103031	0.00064
377.4	107760	0.00073
386.4	109038	0.00076
395.0	110244	0.00108
411.7	112551	0.00090
447.7	117369	0.00075
462.1	119241	0.00135
485.0	122160	0.00180
496.9	123650	0.00125
494.4	123338	0.00200
521.3	126649	0.00170
554.1	130573	0.00170
575.9	133116	0.00210
594.8	135283	0.00170
631.4	139383	0.00210
653.0	141747	0.00180
692.4	145961	0.00200
749.2	151830	0.00250
774.3	154352	0.00440
816.5	158503	0.00470
893.0	165762	0.00510
934.2	169542	0.00520
980.2	173666	0.00700
1011.8	176443	0.00620
1064.2	180955	0.00660
1102.0	184140	0.00810
1139.7	187264	0.00960

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
1174.0	190061	0.01040
1243.3	195590	0.01400
1314.1	201082	0.01630
1353.8	204097	0.01570
1480.9	213462	0.01630
1476.0	213109	0.01700
1392.7	207008	0.01770
1474.2	212979	0.01680
1383.7	206338	0.01780
1354.0	204112	0.01610
1401.5	207661	0.01480
1392.0	206956	0.01440
1375.3	205711	0.01590
1395.7	207231	0.01690

Table C9 Tabulated Results for Cyclic J Specimen GPQ-17

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.51286	340744	0.0123	0.99983	22	214.4
2	0.51604	335257	0.0129	0.99990	23	235.3
3	0.51654	334411	0.0132	0.99992	24	240.5
4	0.51634	334744	0.0135	0.99988	24	249.8
5	0.51599	335350	0.0135	0.99991	24	249.3
6	0.51538	336402	0.0135	0.99989	24	249.5
7	0.51536	336432	0.0136	0.99994	24	254.7
8	0.51591	335491	0.0137	0.99988	25	255.3
9	0.51594	335432	0.0137	0.99993	25	255.1
10	0.51590	335510	0.0138	0.99992	25	260.2
11	0.51555	336098	0.0139	0.99989	26	259.1
12	0.51613	335118	0.0140	0.99991	26	265.7
13	0.51641	334623	0.0139	0.99993	26	260.5
14	0.51609	335178	0.0140	0.99992	26	264.6
15	0.51658	334333	0.0141	0.99989	27	268.4
16	0.51741	332931	0.0142	0.99988	27	273.7
17	0.51810	331751	0.0141	0.99993	27	267.4
18	0.51845	331168	0.0142	0.99988	26	271.5
19	0.51899	330250	0.0143	0.99992	27	276.6
20	0.51931	329704	0.0145	0.99988	26	275.0
21	0.52001	328524	0.0146	0.99990	26	280.9
22	0.52065	327446	0.0145	0.99991	26	279.9
23	0.52103	326801	0.0147	0.99989	27	281.1
24	0.52048	327728	0.0146	0.99990	26	278.3
25	0.52142	326156	0.0147	0.99990	27	283.5
26	0.52137	326231	0.0147	0.99991	27	281.1
27	0.52124	326458	0.0148	0.99990	27	285.2
28	0.52096	326924	0.0149	0.99992	27	289.1
29	0.52279	323858	0.0149	0.99990	27	287.5
30	0.52301	323493	0.0151	0.99989	28	295.8
31	0.52191	325339	0.0151	0.99993	27	288.1
32	0.52284	323781	0.0151	0.99992	27	292.8
33	0.52283	323791	0.0152	0.99991	28	292.8
34	0.52339	322863	0.0152	0.99992	28	296.7
35	0.52382	322150	0.0153	0.99994	28	295.9
36	0.52363	322463	0.0154	0.99991	28	301.6
37	0.52494	320304	0.0155	0.99991	29	301.2
38	0.52502	320161	0.0156	0.99991	29	305.6
39	0.52475	320612	0.0156	0.99992	28	307.2
40	0.52527	319747	0.0156	0.99990	29	303.7
41	0.52536	319609	0.0157	0.99989	29	310.3
42	0.52548	319402	0.0158	0.99989	29	308.2
43	0.52594	318646	0.0158	0.99990	30	307.0
44	0.52669	317409	0.0159	0.99990	30	315.6
45	0.52683	317178	0.0159	0.99990	30	311.7
46	0.52674	317323	0.0159	0.99994	29	310.1

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in^2)
47	0.52662	317522	0.0159	0.99993	30	309.5
48	0.52737	316289	0.0160	0.99993	30	314.4
49	0.52733	316365	0.0161	0.99993	30	314.3
50	0.52701	316890	0.0161	0.99994	30	317.4
51	0.52813	315058	0.0162	0.99995	31	318.6
52	0.52795	315349	0.0164	0.99991	30	323.7
53	0.52921	313295	0.0165	0.99992	31	323.7
54	0.52916	313374	0.0165	0.99992	30	323.3
55	0.53037	311413	0.0165	0.99991	31	324.1
56	0.52955	312743	0.0166	0.99992	30	324.0
57	0.53092	310527	0.0166	0.99990	31	328.2
58	0.53035	311435	0.0167	0.99994	31	331.8
59	0.53146	309654	0.0169	0.99990	31	335.6
60	0.53139	309753	0.0169	0.99992	31	337.2
61	0.53178	309132	0.0170	0.99988	31	336.9
62	0.53287	307378	0.0172	0.99989	31	340.3
63	0.53275	307569	0.0172	0.99987	31	342.4
64	0.53317	306896	0.0173	0.99988	31	347.5
65	0.53443	304884	0.0174	0.99989	31	350.5
66	0.53476	304355	0.0175	0.99991	31	349.6
67	0.53460	304620	0.0175	0.99991	31	347.4
68	0.53568	302893	0.0176	0.99988	31	352.7
69	0.53636	301815	0.0178	0.99991	31	359.8
70	0.53630	301907	0.0179	0.99991	31	357.9
71	0.53687	301007	0.0179	0.99990	31	358.2
72	0.53782	299507	0.0181	0.99989	32	363.5
73	0.53815	298990	0.0182	0.99989	32	369.6
74	0.53854	298384	0.0184	0.99986	32	368.2
75	0.53883	297929	0.0185	0.99992	32	373.7
76	0.53951	296858	0.0186	0.99990	32	375.9
77	0.53994	296183	0.0186	0.99990	32	372.9
78	0.53992	296222	0.0189	0.99989	32	384.9
79	0.54154	293687	0.0189	0.99989	32	387.2
80	0.54153	293703	0.0191	0.99986	32	391.5
81	0.54172	293419	0.0192	0.99987	32	393.4
82	0.54208	292850	0.0193	0.99989	32	388.4
83	0.54359	290527	0.0193	0.99988	32	397.1
84	0.54398	289919	0.0196	0.99989	32	400.9
85	0.54382	290173	0.0197	0.99988	32	397.5
86	0.54401	289869	0.0199	0.99970	32	401.3
87	0.54463	288929	0.0199	0.99970	32	407.9
88	0.54486	288572	0.0202	0.99969	33	412.2
89	0.54526	287952	0.0205	0.99976	32	416.4
90	0.54708	285176	0.0206	0.99978	33	418.7
91	0.54719	285012	0.0209	0.99980	33	422.6
92	0.54779	284099	0.0211	0.99981	34	426.1
93	0.54926	281873	0.0213	0.99980	33	431.5
94	0.54983	281024	0.0214	0.99985	34	436.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
95	0.55083	279526	0.0215	0.99987	33	436.4
96	0.55205	277702	0.0218	0.99985	34	449.0
97	0.55287	276468	0.0221	0.99987	34	454.2
98	0.55353	275493	0.0223	0.99989	34	458.8
99	0.55504	273262	0.0226	0.99990	34	461.8
100	0.55586	272046	0.0230	0.99990	34	469.2
101	0.55696	270435	0.0233	0.99990	34	480.7
102	0.55830	268472	0.0236	0.99988	34	485.7
103	0.55973	266401	0.0239	0.99986	34	490.8
104	0.56098	264594	0.0242	0.99984	33	494.4
105	0.56269	262138	0.0246	0.99983	34	504.3
106	0.56414	260065	0.0250	0.99985	34	512.3
107	0.56473	259216	0.0256	0.99980	34	516.6
108	0.56636	256903	0.0261	0.99983	34	528.0
109	0.56707	255906	0.0268	0.99977	35	534.5
110	0.56853	253849	0.0277	0.99979	34	547.6
111	0.57072	250792	0.0283	0.99984	35	559.2
112	0.57205	248950	0.0292	0.99980	35	565.7
113	0.57508	244775	0.0303	0.99986	35	587.7
114	0.57729	241767	0.0317	0.99981	35	601.5
115	0.57939	238926	0.0331	0.99981	35	620.1
116	0.58210	235293	0.0352	0.99977	35	640.6
117	0.58620	229885	0.0393	0.99982	36	680.5
118	0.58884	226431	0.0408	0.99982	37	697.0
119	0.59176	222659	0.0443	0.99983	37	713.9
120	0.59561	217755	0.0485	0.99981	37	730.5
121	0.59973	212580	0.0526	0.99981	37	746.6
122	0.60370	207671	0.0567	0.99972	37	763.6
123	0.60729	203296	0.0608	0.99980	37	781.4
124	0.61140	198364	0.0649	0.99976	38	800.0
125	0.61587	193087	0.0692	0.99979	38	817.6
126	0.62107	187057	0.0733	0.99980	37	832.6
127	0.62700	180328	0.0775	0.99981	36	854.5
128	0.63441	172137	0.0817	0.99981	37	890.2
129	0.64220	163784	0.0858	0.99977	36	922.6
130	0.65108	154571	0.0898	0.99971	36	960.7
131	0.66160	144080	0.0939	0.99975	36	1017.1
132	0.67335	132888	0.0981	0.99973	35	1070.3
133	0.68419	123039	0.1022	0.99976	36	1145.7
134	0.69761	111462	0.1063	0.99971	37	1240.6
135	0.70921	101998	0.1105	0.99968	37	1332.2
136	0.72081	93025	0.1146	0.99977	36	1447.7
137	0.73510	82628	0.1186	0.99966	37	1596.8
138	0.74831	73638	0.1228	0.99972	37	1768.9
139	0.76566	62738	0.1269	0.99968	39	2066.0
140	0.78011	54409	0.1309	0.99974	40	2378.9
141	0.79430	46886	0.1350	0.99968	43	2741.1
142	0.80969	39445	0.1391	0.99965	43	3323.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
143	0.82538	32601	0.1432	0.99965	45	4087.9
144	0.83820	27555	0.1473	0.99962	45	4902.5

Table C10 Crack Growth Rate Results - Specimen GPQ-17

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
187.8	76016	0.00036
202.2	78877	0.00026
214.6	81259	0.00028
216.8	81675	0.00030
232.5	84580	0.00042
237.0	85395	0.00050
242.1	86309	0.00047
256.6	88856	0.00049
278.9	92637	0.00049
290.7	94576	0.00065
303.2	96588	0.00087
311.6	97917	0.00095
322.3	99584	0.00106
336.0	101678	0.00135
344.7	102986	0.00150
371.3	106886	0.00100
415.4	113055	0.00129
455.5	118387	0.00167
481.7	121744	0.00310
523.4	126904	0.00215
601.7	136066	0.00270
629.4	139162	0.00410
694.6	146193	0.00260
769.8	153903	0.00300
774.1	154332	0.00380
761.4	153061	0.00410
765.8	153503	0.00400
760.1	152930	0.00360
771.9	154113	0.00410
780.2	154939	0.00450
782.2	155138	0.00520
821.8	159016	0.00590
839.6	160729	0.00740
858.3	162509	0.00780
889.8	165464	0.00890
926.6	168851	0.01050
986.2	174197	0.01170
976.1	173303	0.01090
961.1	171966	0.01340
956.6	171563	0.01160
961.8	172029	0.01160
938.8	169959	0.01430
932.6	169397	0.01320
914.9	167782	0.01740
884.8	164999	0.01440

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
882.2	164756	0.01420
828.0	159615	0.01540
775.4	154462	0.01570

Table C11 Tabulated Results for Cyclic J Specimen GPQ-8

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.50269	358701	0.0214	0.99962	23	59.3
2	0.50378	356741	0.0225	0.99965	27	66.3
3	0.50373	356818	0.0244	0.99963	28	68.7
4	0.50487	354786	0.0253	0.99981	28	67.7
5	0.50387	356569	0.0261	0.99962	29	70.7
6	0.50448	355486	0.0270	0.99980	27	71.3
7	0.50352	357203	0.0279	0.99959	28	71.9
8	0.50545	353758	0.0287	0.99975	28	70.8
9	0.50593	352903	0.0293	0.99981	29	72.2
10	0.50594	352870	0.0298	0.99984	29	71.9
11	0.50530	354013	0.0304	0.99980	29	72.0
12	0.50572	353270	0.0310	0.99979	29	73.1
13	0.50638	352095	0.0316	0.99982	29	72.0
14	0.50790	349415	0.0320	0.99991	28	71.0
15	0.50743	350244	0.0325	0.99978	30	74.4
16	0.50753	350051	0.0330	0.99980	30	75.2
17	0.50752	350079	0.0334	0.99985	29	72.8
18	0.50798	349272	0.0339	0.99970	31	71.7
19	0.50847	348399	0.0341	0.99982	31	71.2
20	0.50758	349963	0.0346	0.99979	31	70.6
21	0.50863	348121	0.0351	0.99978	32	76.5
22	0.50813	349005	0.0355	0.99974	32	73.1
23	0.50795	349317	0.0358	0.99986	31	69.6
24	0.50782	349552	0.0361	0.99984	33	75.0
25	0.50846	348412	0.0363	0.99986	32	71.6
26	0.50787	349453	0.0366	0.99984	33	76.7
27	0.50913	347238	0.0369	0.99986	33	76.5
28	0.50833	348651	0.0372	0.99988	32	73.6
29	0.50916	347195	0.0375	0.99984	33	74.6
30	0.50909	347308	0.0377	0.99985	33	78.9
31	0.50847	348394	0.0379	0.99986	33	72.6
32	0.50889	347654	0.0381	0.99986	33	72.9
33	0.50885	347741	0.0384	0.99983	33	71.8
34	0.50879	347844	0.0387	0.99982	33	70.0
35	0.50890	347652	0.0389	0.99981	34	75.6
36	0.50953	346538	0.0391	0.99986	33	71.9
37	0.50953	346536	0.0393	0.99986	34	71.8
38	0.50921	347102	0.0395	0.99981	34	77.9
39	0.50982	346037	0.0397	0.99987	34	75.8
40	0.50952	346549	0.0399	0.99986	34	72.9
41	0.51000	345718	0.0400	0.99987	34	71.7
42	0.50996	345782	0.0403	0.99983	35	75.1
43	0.51015	345449	0.0405	0.99983	35	74.5
44	0.50971	346220	0.0407	0.99985	35	72.1
45	0.50965	346336	0.0409	0.99986	35	70.4
46	0.50997	345773	0.0410	0.99983	35	74.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
47	0.50963	346367	0.0413	0.99984	35	72.4
48	0.51040	345023	0.0416	0.99982	36	80.7
49	0.51067	344548	0.0416	0.99987	35	69.8
50	0.50985	345976	0.0419	0.99985	35	78.3
51	0.51075	344405	0.0420	0.99986	36	72.3
52	0.51059	344685	0.0422	0.99983	36	81.5
53	0.51091	344121	0.0424	0.99985	36	80.0
54	0.51068	344530	0.0425	0.99987	36	79.2
55	0.51079	344327	0.0427	0.99985	36	81.0
56	0.51097	344020	0.0428	0.99987	36	79.3
57	0.51047	344885	0.0430	0.99984	36	84.6
58	0.51104	343901	0.0431	0.99988	37	80.6
59	0.51102	343936	0.0434	0.99984	36	78.8
60	0.51134	343373	0.0436	0.99983	37	78.0
61	0.51143	343216	0.0436	0.99985	36	78.3
62	0.51084	344256	0.0438	0.99985	36	75.5
63	0.51150	343091	0.0439	0.99987	36	78.6
64	0.51101	343943	0.0441	0.99983	36	76.4
65	0.51093	344088	0.0442	0.99984	36	77.0
66	0.51156	342991	0.0445	0.99986	36	81.7
67	0.51192	342373	0.0446	0.99985	37	78.9
68	0.51168	342790	0.0447	0.99985	37	77.1
69	0.51152	343054	0.0449	0.99988	37	82.0
70	0.51172	342713	0.0451	0.99987	37	84.5
71	0.51222	341839	0.0452	0.99989	36	83.9
72	0.51191	342391	0.0452	0.99984	37	83.2
73	0.51207	342102	0.0453	0.99987	37	79.2
74	0.51189	342421	0.0455	0.99987	37	75.5
75	0.51214	341977	0.0457	0.99982	38	79.2
76	0.51191	342383	0.0459	0.99985	37	80.6
77	0.51235	341624	0.0459	0.99988	36	81.9
78	0.51228	341741	0.0461	0.99984	38	86.1
79	0.51229	341727	0.0463	0.99987	38	81.4
80	0.51168	342788	0.0464	0.99983	38	78.8
81	0.51313	340276	0.0465	0.99986	37	84.9
82	0.51276	340912	0.0468	0.99987	38	79.0
83	0.51255	341282	0.0469	0.99984	38	84.0
84	0.51273	340964	0.0470	0.99984	38	87.9
85	0.51239	341543	0.0472	0.99982	38	86.7
86	0.51269	341024	0.0475	0.99986	38	77.1
87	0.51298	340529	0.0475	0.99983	37	78.9
88	0.51276	340910	0.0478	0.99984	38	88.5
89	0.51305	340401	0.0479	0.99983	38	85.8
90	0.51331	339962	0.0482	0.99981	39	85.2
91	0.51387	338991	0.0482	0.99987	38	78.2
92	0.51334	339898	0.0485	0.99980	39	86.0
93	0.51322	340107	0.0486	0.99983	37	86.6
94	0.51347	339676	0.0489	0.99983	39	81.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
95	0.51382	339082	0.0492	0.99983	39	81.0
96	0.51390	338941	0.0493	0.99982	39	82.3
97	0.51408	338630	0.0496	0.99984	38	86.2
98	0.51449	337930	0.0497	0.99987	38	86.0
99	0.51449	337929	0.0500	0.99982	39	82.8
100	0.51454	337835	0.0501	0.99986	38	76.5
101	0.51492	337182	0.0503	0.99986	38	89.7
102	0.51410	338591	0.0505	0.99985	38	78.1
103	0.51481	337369	0.0506	0.99988	38	81.4
104	0.51441	338064	0.0508	0.99982	39	91.0
105	0.51516	336780	0.0510	0.99986	38	87.0
106	0.51478	337424	0.0512	0.99982	39	86.2
107	0.51537	336411	0.0514	0.99980	39	89.3
108	0.51487	337269	0.0515	0.99985	38	88.3
109	0.51458	337760	0.0518	0.99985	39	86.6
110	0.51553	336131	0.0519	0.99983	39	83.3
111	0.51589	335518	0.0522	0.99983	39	77.4
112	0.51564	335946	0.0522	0.99985	38	86.6
113	0.51583	335628	0.0524	0.99985	38	85.7
114	0.51535	336438	0.0525	0.99982	38	86.5
115	0.51592	335470	0.0526	0.99984	39	79.6
116	0.51613	335104	0.0527	0.99987	39	79.8
117	0.51628	334855	0.0528	0.99986	39	82.4
118	0.51615	335069	0.0530	0.99987	39	75.3
119	0.51657	334366	0.0531	0.99987	39	88.8
120	0.51647	334521	0.0532	0.99988	39	89.9
121	0.51638	334679	0.0534	0.99983	39	90.0
122	0.51694	333728	0.0536	0.99984	39	77.1
123	0.51647	334520	0.0536	0.99987	39	88.1
124	0.51654	334413	0.0538	0.99985	39	89.1
125	0.51705	333535	0.0539	0.99988	39	90.4
126	0.51701	333599	0.0542	0.99984	39	86.9
127	0.51681	333957	0.0544	0.99984	39	75.0
128	0.51664	334236	0.0546	0.99982	39	85.0
129	0.51743	332891	0.0547	0.99986	38	88.0
130	0.51738	332971	0.0550	0.99982	39	83.6
131	0.51742	332903	0.0552	0.99987	39	78.0
132	0.51766	332503	0.0553	0.99982	40	82.8
133	0.51845	331155	0.0554	0.99986	38	86.7
134	0.51819	331598	0.0555	0.99985	38	85.1
135	0.51873	330689	0.0557	0.99984	39	92.5
136	0.51901	330213	0.0558	0.99988	38	82.3
137	0.51822	331555	0.0560	0.99985	39	93.7
138	0.51883	330516	0.0562	0.99984	39	90.8
139	0.51875	330654	0.0563	0.99981	39	93.0
140	0.51921	329876	0.0564	0.99986	38	75.7
141	0.51875	330645	0.0567	0.99982	40	91.5
142	0.51957	329261	0.0569	0.99986	39	86.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
143	0.51909	330069	0.0571	0.99985	40	87.5
144	0.51962	329188	0.0574	0.99979	40	91.9
145	0.51986	328780	0.0575	0.99983	39	72.9
146	0.51916	329961	0.0578	0.99981	40	85.9
147	0.51978	328917	0.0580	0.99984	39	90.7
148	0.52007	328430	0.0582	0.99979	40	89.5
149	0.52000	328534	0.0584	0.99984	39	79.1
150	0.52063	327488	0.0586	0.99984	39	78.2
151	0.52073	327311	0.0587	0.99986	39	89.5
152	0.52061	327514	0.0589	0.99985	40	78.2
153	0.52081	327171	0.0590	0.99985	39	75.5
154	0.52072	327335	0.0592	0.99985	39	75.3
155	0.52081	327186	0.0594	0.99982	39	80.9
156	0.52100	326851	0.0596	0.99985	39	83.5
157	0.52079	327204	0.0599	0.99982	40	80.6
158	0.52134	326292	0.0600	0.99986	39	74.9
159	0.52113	326646	0.0602	0.99986	39	91.7
160	0.52194	325286	0.0604	0.99985	38	88.8
161	0.52119	326547	0.0606	0.99984	39	93.1
162	0.52138	326224	0.0608	0.99984	40	96.4
163	0.52163	325803	0.0611	0.99983	40	77.4
164	0.52184	325453	0.0613	0.99984	39	78.2
165	0.52135	326278	0.0616	0.99979	40	92.3
166	0.52210	325015	0.0618	0.99983	39	76.4
167	0.52186	325420	0.0621	0.99972	40	76.7
168	0.52255	324263	0.0624	0.99983	40	77.4
169	0.52267	324066	0.0626	0.99985	39	74.5
170	0.52334	322952	0.0628	0.99985	40	91.0
171	0.52354	322611	0.0629	0.99986	39	76.0
172	0.52336	322917	0.0632	0.99985	39	77.1
173	0.52344	322776	0.0634	0.99985	39	93.8
174	0.52397	321908	0.0636	0.99986	40	90.9
175	0.52412	321650	0.0637	0.99985	39	75.8
176	0.52385	322106	0.0640	0.99982	39	92.1
177	0.52462	320824	0.0641	0.99982	40	87.9
178	0.52468	320721	0.0643	0.99981	40	90.6
179	0.52532	319672	0.0645	0.99986	40	89.0
180	0.52494	320291	0.0646	0.99985	39	75.0
181	0.52484	320457	0.0648	0.99979	41	82.2
182	0.52546	319437	0.0651	0.99981	40	86.5
183	0.52586	318771	0.0653	0.99982	40	91.6
184	0.52606	318442	0.0656	0.99982	40	89.6
185	0.52578	318904	0.0657	0.99981	40	81.7
186	0.52594	318644	0.0660	0.99977	40	87.8
187	0.52538	319575	0.0663	0.99975	40	87.8
188	0.52577	318922	0.0664	0.99979	40	87.0
189	0.52603	318493	0.0666	0.99979	40	91.5
190	0.52609	318397	0.0668	0.99976	40	82.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
191	0.52641	317879	0.0671	0.99978	41	80.8
192	0.52601	318537	0.0673	0.99978	40	78.8
193	0.52603	318504	0.0675	0.99983	40	81.5
194	0.52644	317824	0.0677	0.99984	41	80.5
195	0.52642	317856	0.0680	0.99978	40	80.7
196	0.52687	317116	0.0682	0.99984	40	78.5
197	0.52701	316893	0.0684	0.99984	40	80.7
198	0.52707	316789	0.0686	0.99981	40	80.5
199	0.52746	316143	0.0689	0.99984	40	81.0
200	0.52741	316232	0.0692	0.99982	40	78.5
201	0.52737	316302	0.0694	0.99985	40	79.6
202	0.52805	315177	0.0697	0.99984	40	80.6
203	0.52776	315659	0.0700	0.99980	40	80.5
204	0.52791	315416	0.0701	0.99981	40	78.0
205	0.52847	314498	0.0703	0.99985	40	79.4
206	0.52804	315199	0.0706	0.99980	40	80.0
207	0.52824	314868	0.0709	0.99981	41	81.0
208	0.52857	314336	0.0711	0.99983	40	77.7
209	0.52855	314375	0.0712	0.99982	40	79.4
210	0.52874	314063	0.0715	0.99982	40	79.7
211	0.52859	314296	0.0718	0.99981	41	81.1
212	0.52889	313818	0.0721	0.99984	41	79.7
213	0.52910	313466	0.0724	0.99984	40	78.2
214	0.52947	312869	0.0726	0.99982	40	79.3
215	0.52994	312114	0.0727	0.99987	40	78.5
216	0.52974	312434	0.0730	0.99983	40	80.3
217	0.53016	311752	0.0732	0.99986	40	77.7
218	0.53029	311537	0.0734	0.99985	40	87.1
219	0.52968	312533	0.0736	0.99981	40	80.3
220	0.53059	311058	0.0740	0.99982	41	80.5
221	0.53035	311447	0.0743	0.99983	41	81.1
222	0.53052	311162	0.0745	0.99986	40	86.8
223	0.53075	310796	0.0748	0.99985	40	80.1
224	0.53105	310306	0.0750	0.99984	40	80.5
225	0.53030	311530	0.0753	0.99977	41	85.6
226	0.53085	310629	0.0756	0.99982	40	79.2
227	0.53117	310115	0.0759	0.99983	40	79.9
228	0.53135	309831	0.0760	0.99986	40	79.5
229	0.53191	308916	0.0762	0.99986	41	85.8
230	0.53201	308757	0.0764	0.99984	41	79.7
231	0.53177	309152	0.0767	0.99981	40	80.8
232	0.53213	308574	0.0770	0.99987	40	92.6
233	0.53237	308185	0.0772	0.99986	41	86.9
234	0.53203	308722	0.0774	0.99986	40	79.1
235	0.53237	308186	0.0776	0.99983	40	89.7
236	0.53240	308133	0.0779	0.99979	42	84.7
237	0.53270	307644	0.0783	0.99979	42	84.9
238	0.53282	307452	0.0786	0.99984	40	80.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
239	0.53306	307076	0.0789	0.99983	40	90.2
240	0.53311	306992	0.0792	0.99979	42	84.8
241	0.53352	306338	0.0794	0.99982	41	79.5
242	0.53387	305771	0.0797	0.99984	40	86.0
243	0.53387	305772	0.0800	0.99982	40	87.5
244	0.53475	304372	0.0802	0.99985	41	83.3
245	0.53441	304913	0.0805	0.99983	41	85.3
246	0.53435	305017	0.0807	0.99984	41	85.9
247	0.53494	304071	0.0809	0.99983	41	82.7
248	0.53479	304312	0.0811	0.99984	41	84.6
249	0.53488	304168	0.0814	0.99985	40	85.9
250	0.53513	303770	0.0817	0.99983	40	85.7
251	0.53536	303403	0.0819	0.99984	41	82.9
252	0.53574	302797	0.0821	0.99982	41	84.9
253	0.53541	303329	0.0824	0.99981	40	85.6
254	0.53558	303046	0.0827	0.99980	42	85.4
255	0.53575	302791	0.0830	0.99984	40	85.6
256	0.53681	301105	0.0832	0.99981	41	85.6
257	0.53613	302187	0.0836	0.99978	42	85.4
258	0.53589	302555	0.0838	0.99984	40	84.8
259	0.53668	301310	0.0841	0.99981	41	85.7
260	0.53688	300988	0.0845	0.99981	42	86.3
261	0.53719	300496	0.0848	0.99983	41	85.2
262	0.53762	299827	0.0850	0.99983	41	85.8
263	0.53721	300478	0.0853	0.99980	42	85.3
264	0.53762	299831	0.0856	0.99981	41	85.0
265	0.53819	298922	0.0858	0.99982	41	86.2
266	0.53812	299033	0.0862	0.99976	43	87.3
267	0.53881	297962	0.0865	0.99982	41	86.5
268	0.53905	297574	0.0868	0.99983	41	86.0
269	0.53872	298101	0.0870	0.99980	42	85.2
270	0.53918	297373	0.0873	0.99984	41	85.2
271	0.53955	296799	0.0876	0.99982	41	86.5
272	0.53973	296516	0.0879	0.99982	41	86.4
273	0.53942	297004	0.0883	0.99980	42	86.7
274	0.54009	295951	0.0886	0.99984	41	86.0
275	0.54040	295472	0.0889	0.99983	41	86.3
276	0.54032	295589	0.0892	0.99981	42	85.8
277	0.53982	296378	0.0897	0.99982	41	88.6
278	0.54074	294940	0.0900	0.99982	41	86.4
279	0.54071	294977	0.0903	0.99981	42	86.4
280	0.54122	294184	0.0906	0.99984	41	86.5
281	0.54157	293646	0.0909	0.99983	41	86.8
282	0.54138	293942	0.0912	0.99982	42	85.6
283	0.54160	293603	0.0915	0.99985	41	85.2
284	0.54195	293062	0.0917	0.99983	41	86.5
285	0.54225	292591	0.0920	0.99984	41	86.6
286	0.54187	293182	0.0924	0.99981	42	85.8

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
287	0.54243	292314	0.0927	0.99985	41	86.8
288	0.54236	292418	0.0931	0.99979	42	88.2
289	0.54242	292322	0.0934	0.99980	41	85.1
290	0.54283	291697	0.0936	0.99985	41	85.9
291	0.54358	290532	0.0939	0.99988	41	86.4
292	0.54378	290238	0.0943	0.99986	42	86.8
293	0.54402	289866	0.0947	0.99982	42	89.9
294	0.54471	288796	0.0950	0.99986	41	87.2
295	0.54442	289248	0.0954	0.99981	43	88.3
296	0.54444	289220	0.0959	0.99980	42	87.5
297	0.54527	287939	0.0962	0.99983	41	87.4
298	0.54545	287666	0.0965	0.99983	41	87.6
299	0.54491	288495	0.0968	0.99979	42	86.6
300	0.54503	288307	0.0972	0.99980	42	87.5
301	0.54575	287213	0.0975	0.99981	41	87.4
302	0.54524	287983	0.0979	0.99978	42	92.9
303	0.54521	288033	0.0983	0.99976	42	89.6
304	0.54568	287322	0.0987	0.99982	41	86.7
305	0.54570	287281	0.0990	0.99984	42	92.2
306	0.54580	287128	0.0995	0.99980	42	89.5
307	0.54586	287034	0.0998	0.99983	41	87.3
308	0.54620	286526	0.1001	0.99984	41	90.9
309	0.54637	286267	0.1004	0.99984	41	86.9
310	0.54690	285451	0.1006	0.99986	41	87.7
311	0.54696	285365	0.1009	0.99984	41	87.7
312	0.54674	285705	0.1013	0.99982	42	92.4
313	0.54734	284790	0.1016	0.99983	41	88.7
314	0.54743	284651	0.1019	0.99982	41	91.6
315	0.54714	285097	0.1024	0.99979	43	89.9
316	0.54790	283931	0.1027	0.99985	41	87.6
317	0.54798	283820	0.1030	0.99980	42	90.0
318	0.54778	284112	0.1034	0.99982	42	91.5
319	0.54857	282917	0.1037	0.99986	41	88.1
320	0.54796	283839	0.1040	0.99982	42	92.1
321	0.54832	283300	0.1045	0.99979	43	90.1
322	0.54907	282162	0.1048	0.99985	41	87.7
323	0.54875	282657	0.1051	0.99983	42	92.4
324	0.54882	282549	0.1056	0.99980	42	93.9
325	0.54949	281527	0.1060	0.99982	41	90.1
326	0.54924	281915	0.1064	0.99973	44	97.2
327	0.54969	281229	0.1070	0.99981	42	93.3
328	0.55010	280613	0.1073	0.99982	41	92.9
329	0.55004	280702	0.1076	0.99984	41	93.1
330	0.55014	280549	0.1080	0.99982	42	93.9
331	0.55084	279506	0.1083	0.99984	41	94.0
332	0.55109	279136	0.1086	0.99978	42	92.3
333	0.55107	279156	0.1089	0.99985	41	92.5
334	0.55089	279433	0.1092	0.99982	42	94.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
335	0.55157	278410	0.1096	0.99979	42	92.7
336	0.55139	278685	0.1100	0.99979	42	96.0
337	0.55183	278026	0.1103	0.99984	41	93.6
338	0.55222	277443	0.1107	0.99979	42	92.9
339	0.55204	277703	0.1110	0.99980	41	93.7
340	0.55268	276755	0.1114	0.99979	43	94.6
341	0.55262	276850	0.1118	0.99980	42	95.9
342	0.55293	276389	0.1121	0.99982	41	93.9
343	0.55322	275953	0.1124	0.99982	43	93.0
344	0.55347	275575	0.1127	0.99981	42	93.6
345	0.55338	275720	0.1130	0.99983	41	94.3
346	0.55377	275130	0.1134	0.99980	42	94.4
347	0.55389	274957	0.1137	0.99984	41	94.2
348	0.55419	274513	0.1141	0.99979	43	95.3
349	0.55383	275042	0.1145	0.99979	42	95.9
350	0.55424	274447	0.1151	0.99978	43	98.4
351	0.55526	272930	0.1154	0.99985	42	93.4
352	0.55500	273321	0.1157	0.99986	41	94.3
353	0.55529	272889	0.1160	0.99982	43	93.7
354	0.55500	273318	0.1165	0.99982	42	96.5
355	0.55521	273012	0.1168	0.99983	41	94.4
356	0.55579	272153	0.1172	0.99981	43	94.6
357	0.55574	272222	0.1177	0.99977	43	98.5
358	0.55593	271944	0.1183	0.99979	43	98.4
359	0.55653	271071	0.1187	0.99984	42	95.0
360	0.55624	271491	0.1192	0.99977	43	99.3
361	0.55659	270975	0.1197	0.99979	43	97.5
362	0.55675	270748	0.1202	0.99981	42	95.9
363	0.55735	269864	0.1206	0.99983	41	96.0
364	0.55786	269124	0.1210	0.99983	42	94.2
365	0.55754	269589	0.1214	0.99981	42	97.4
366	0.55768	269381	0.1220	0.99977	43	99.2
367	0.55786	269121	0.1226	0.99979	43	98.0
368	0.55838	268359	0.1230	0.99980	42	96.2
369	0.55873	267848	0.1235	0.99980	43	99.7
370	0.55892	267567	0.1241	0.99981	43	98.6
371	0.55896	267522	0.1248	0.99977	43	100.2
372	0.55933	266979	0.1253	0.99978	42	98.9
373	0.55968	266468	0.1259	0.99976	43	100.2
374	0.56029	265586	0.1265	0.99978	43	98.9
375	0.56073	264948	0.1271	0.99978	43	99.4
376	0.56128	264153	0.1278	0.99973	44	97.7
377	0.56169	263568	0.1283	0.99981	42	98.7
378	0.56214	262923	0.1289	0.99981	43	101.5
379	0.56229	262710	0.1296	0.99977	43	100.5
380	0.56259	262270	0.1302	0.99976	43	100.2
381	0.56332	261227	0.1309	0.99977	43	97.2
382	0.56383	260506	0.1315	0.99981	42	100.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
383	0.56387	260439	0.1320	0.99979	43	101.4
384	0.56394	260346	0.1326	0.99980	42	100.6
385	0.56459	259421	0.1331	0.99980	43	100.3
386	0.56456	259457	0.1339	0.99975	44	97.8
387	0.56556	258042	0.1345	0.99980	43	101.8
388	0.56592	257525	0.1351	0.99978	43	101.0
389	0.56624	257074	0.1359	0.99973	44	101.1
390	0.56674	256362	0.1368	0.99977	44	104.3
391	0.56712	255835	0.1375	0.99976	43	102.4
392	0.56769	255026	0.1383	0.99973	44	101.8
393	0.56756	255214	0.1392	0.99972	44	103.6
394	0.56846	253947	0.1398	0.99980	43	102.5
395	0.56923	252872	0.1405	0.99979	44	102.1
396	0.56857	253792	0.1411	0.99973	44	104.6
397	0.56900	253196	0.1419	0.99970	44	105.5
398	0.56952	252463	0.1428	0.99974	44	107.2
399	0.56968	252245	0.1436	0.99972	44	105.0
400	0.57065	250895	0.1442	0.99979	44	101.2
401	0.57076	250739	0.1449	0.99975	44	106.0
402	0.57139	249860	0.1455	0.99975	44	102.9
403	0.57160	249571	0.1461	0.99978	44	104.5
404	0.57175	249367	0.1469	0.99977	44	107.4
405	0.57169	249445	0.1478	0.99967	45	106.2
406	0.57233	248559	0.1485	0.99979	44	105.1
407	0.57241	248443	0.1494	0.99972	45	106.8
408	0.57373	246633	0.1501	0.99979	44	104.4
409	0.57342	247049	0.1509	0.99971	45	108.2
410	0.57362	246777	0.1517	0.99975	43	106.5
411	0.57451	245554	0.1525	0.99977	45	106.0
412	0.57435	245780	0.1533	0.99970	45	106.8
413	0.57494	244972	0.1543	0.99975	44	109.0
414	0.57573	243890	0.1551	0.99979	44	106.0
415	0.57588	243687	0.1557	0.99976	44	104.4
416	0.57602	243490	0.1565	0.99978	44	108.3
417	0.57642	242953	0.1573	0.99980	44	107.7
418	0.57755	241414	0.1581	0.99980	44	106.7
419	0.57704	242102	0.1589	0.99970	45	108.3
420	0.57808	240702	0.1597	0.99973	44	106.6
421	0.57804	240747	0.1606	0.99965	46	109.1
422	0.57779	241089	0.1615	0.99969	45	110.0
423	0.57880	239721	0.1623	0.99979	44	106.8
424	0.57880	239729	0.1631	0.99972	45	108.7
425	0.57936	238965	0.1639	0.99979	44	106.2
426	0.57942	238891	0.1647	0.99970	46	109.2
427	0.57981	238358	0.1657	0.99976	45	108.9
428	0.58017	237882	0.1665	0.99973	45	108.7
429	0.58036	237627	0.1674	0.99972	45	110.7
430	0.58076	237090	0.1681	0.99977	44	107.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
431	0.58089	236914	0.1690	0.99971	46	109.4
432	0.58176	235756	0.1698	0.99979	45	108.7
433	0.58190	235565	0.1705	0.99979	44	112.7
434	0.58188	235598	0.1714	0.99972	45	112.4
435	0.58279	234375	0.1723	0.99977	45	113.6
436	0.58308	233998	0.1732	0.99976	45	113.3
437	0.58333	233665	0.1743	0.99966	46	115.6
438	0.58406	232698	0.1756	0.99973	45	114.5
439	0.58461	231978	0.1766	0.99971	45	113.7
440	0.58495	231525	0.1778	0.99965	46	117.4
441	0.58561	230651	0.1789	0.99970	45	114.9
442	0.58594	230218	0.1800	0.99971	45	116.3
443	0.58681	229085	0.1810	0.99974	45	113.5
444	0.58677	229135	0.1821	0.99971	45	117.4
445	0.58791	227645	0.1832	0.99976	45	113.7
446	0.58785	227717	0.1843	0.99966	46	116.8
447	0.58904	226180	0.1857	0.99966	46	115.1
448	0.58942	225684	0.1869	0.99975	45	116.0
449	0.59072	224004	0.1882	0.99970	46	115.4
450	0.59144	223079	0.1896	0.99966	46	120.2
451	0.59171	222728	0.1909	0.99964	46	114.6
452	0.59228	221990	0.1923	0.99964	46	120.8
453	0.59229	221980	0.1938	0.99953	46	117.9
454	0.59341	220555	0.1952	0.99974	45	119.2
455	0.59361	220301	0.1966	0.99954	46	118.5
456	0.59477	218820	0.1981	0.99966	46	115.8
457	0.59549	217904	0.1995	0.99965	46	117.6
458	0.59590	217388	0.2013	0.99955	46	121.5
459	0.59658	216527	0.2029	0.99957	46	121.0
460	0.59802	214724	0.2048	0.99960	46	118.9
461	0.59851	214100	0.2067	0.99954	46	118.2
462	0.59968	212643	0.2084	0.99960	46	123.3
463	0.60053	211583	0.2105	0.99959	45	121.5
464	0.60261	209012	0.2126	0.99962	46	123.0
465	0.60308	208436	0.2149	0.99959	46	123.0
466	0.60399	207316	0.2174	0.99962	45	124.9
467	0.60555	205405	0.2198	0.99966	45	127.1
468	0.60641	204363	0.2225	0.99945	46	124.1
469	0.60721	203400	0.2254	0.99955	46	124.7
470	0.60986	200207	0.2296	0.99963	44	124.2
471	0.61212	197500	0.2338	0.99963	45	131.0
472	0.61397	195321	0.2380	0.99960	44	131.7
473	0.61593	193013	0.2421	0.99962	44	132.2

Table C12 Crack Growth Rate Results - Specimen GPQ-8

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
72.3	47166	0.00013
80.6	49800	0.00008
86.2	51501	0.00006
83.3	50627	0.00010
90.4	52740	0.00010
89.5	52477	0.00012
91.0	52915	0.00012
89.6	52506	0.00019
78.2	49053	0.00013
79.7	49521	0.00014
85.7	51351	0.00016
86.2	51501	0.00018
86.5	51590	0.00021
89.9	52594	0.00019
88.7	52242	0.00020
92.9	53465	0.00016
93.0	53493	0.00020
95.0	54065	0.00020
98.9	55164	0.00022
101.5	55884	0.00035
101.8	55967	0.00041
102.5	56159	0.00040
102.9	56269	0.00036
106.0	57110	0.00034
106.7	57298	0.00037
108.7	57833	0.00037
113.3	59044	0.00033
113.5	59096	0.00044
115.1	59511	0.00049
120.8	60967	0.00072
117.6	60154	0.00058
118.9	60485	0.00066
123.0	61519	0.00095
127.1	62536	0.00108
124.7	61943	0.00114
131.0	63488	0.00173
131.7	63658	0.00226
132.2	63778	0.00191

Table C13 Tabulated Results for Cyclic J Specimen GPQ-20

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.51543	336304	0.0192	0.99974	36	67.6
2	0.51318	340175	0.0201	0.99954	42	68.3
3	0.51329	339999	0.0213	0.99976	42	70.3
4	0.51365	339363	0.0222	0.99985	42	68.6
5	0.51585	335588	0.0231	0.99988	42	72.8
6	0.51637	334700	0.0240	0.99985	43	73.2
7	0.51726	333175	0.0246	0.99989	42	86.1
8	0.51732	333077	0.0251	0.99990	41	77.0
9	0.51673	334092	0.0257	0.99984	41	75.5
10	0.51760	332606	0.0262	0.99987	42	74.5
11	0.51765	332518	0.0265	0.99992	41	75.4
12	0.51749	332782	0.0269	0.99989	42	75.8
13	0.51750	332777	0.0273	0.99987	42	77.4
14	0.51827	331466	0.0276	0.99992	42	74.5
15	0.51776	332338	0.0278	0.99989	41	72.6
16	0.51751	332757	0.0281	0.99990	41	75.7
17	0.51752	332733	0.0283	0.99992	41	74.8
18	0.51815	331661	0.0286	0.99989	42	75.3
19	0.51846	331145	0.0288	0.99989	42	76.1
20	0.51904	330157	0.0291	0.99990	42	75.5
21	0.51837	331291	0.0293	0.99991	42	74.1
22	0.51906	330132	0.0296	0.99991	41	72.3
23	0.51893	330345	0.0298	0.99994	41	75.8
24	0.51927	329772	0.0300	0.99994	41	77.9
25	0.51894	330332	0.0302	0.99994	41	76.2
26	0.51969	329071	0.0305	0.99993	42	77.3
27	0.51992	328668	0.0307	0.99992	42	76.5
28	0.52009	328381	0.0309	0.99995	42	74.3
29	0.51976	328944	0.0310	0.99994	42	73.9
30	0.51998	328581	0.0313	0.99994	42	75.7
31	0.52012	328341	0.0314	0.99993	42	75.2
32	0.52087	327085	0.0316	0.99995	42	76.8
33	0.52048	327729	0.0316	0.99994	41	73.5
34	0.52069	327377	0.0318	0.99994	42	73.7
35	0.52072	327334	0.0320	0.99993	42	79.5
36	0.52071	327340	0.0321	0.99991	41	74.2
37	0.52113	326648	0.0323	0.99992	42	79.5
38	0.52086	327091	0.0324	0.99993	42	77.2
39	0.52105	326769	0.0326	0.99992	43	77.2
40	0.52132	326318	0.0328	0.99991	42	78.7
41	0.52193	325297	0.0328	0.99993	41	73.9
42	0.52166	325756	0.0330	0.99992	42	78.7
43	0.52219	324874	0.0331	0.99993	42	77.0
44	0.52192	325317	0.0333	0.99993	42	77.0
45	0.52164	325789	0.0334	0.99995	41	77.2
46	0.52220	324844	0.0335	0.99995	41	76.8

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
47	0.52190	325346	0.0335	0.99993	41	76.9
48	0.52193	325303	0.0336	0.99993	42	75.6
49	0.52233	324632	0.0338	0.99994	42	76.1
50	0.52248	324390	0.0340	0.99991	43	77.6
51	0.52299	323525	0.0340	0.99994	42	77.1
52	0.52242	324475	0.0342	0.99991	42	77.3
53	0.52296	323581	0.0343	0.99993	42	75.6
54	0.52316	323242	0.0344	0.99994	42	75.3
55	0.52293	323634	0.0345	0.99994	42	77.1
56	0.52289	323705	0.0345	0.99993	42	76.4
57	0.52340	322857	0.0348	0.99995	42	80.9
58	0.52292	323643	0.0349	0.99993	42	79.3
59	0.52337	322902	0.0350	0.99993	42	79.3
60	0.52346	322746	0.0352	0.99994	42	81.1
61	0.52346	322744	0.0353	0.99994	42	75.8
62	0.52402	321824	0.0353	0.99994	42	76.3
63	0.52336	322922	0.0354	0.99995	42	79.1
64	0.52378	322219	0.0356	0.99993	42	80.2
65	0.52415	321603	0.0356	0.99994	42	75.9
66	0.52400	321850	0.0357	0.99995	42	75.9
67	0.52380	322192	0.0359	0.99991	42	79.7
68	0.52335	322934	0.0359	0.99991	42	77.8
69	0.52419	321543	0.0360	0.99991	42	76.6
70	0.52425	321444	0.0362	0.99991	43	79.4
71	0.52407	321729	0.0363	0.99991	42	79.1
72	0.52471	320670	0.0364	0.99991	43	78.2
73	0.52471	320678	0.0366	0.99991	43	79.9
74	0.52439	321200	0.0366	0.99992	42	79.1
75	0.52449	321046	0.0366	0.99993	42	79.0
76	0.52433	321309	0.0367	0.99992	42	78.5
77	0.52475	320607	0.0369	0.99992	43	77.5
78	0.52503	320145	0.0370	0.99990	43	79.0
79	0.52508	320058	0.0370	0.99992	42	78.8
80	0.52542	319504	0.0371	0.99993	42	79.0
81	0.52511	320014	0.0373	0.99991	43	83.0
82	0.52540	319535	0.0373	0.99992	43	77.6
83	0.52510	320030	0.0374	0.99993	42	78.6
84	0.52580	318872	0.0376	0.99991	43	79.7
85	0.52548	319407	0.0377	0.99990	43	82.0
86	0.52560	319214	0.0377	0.99992	43	78.9
87	0.52580	318882	0.0379	0.99991	43	78.8
88	0.52593	318668	0.0380	0.99993	42	79.0
89	0.52559	319214	0.0381	0.99992	43	77.0
90	0.52589	318735	0.0382	0.99992	43	78.7
91	0.52584	318809	0.0383	0.99993	43	78.5
92	0.52603	318495	0.0384	0.99993	43	78.3
93	0.52632	318016	0.0385	0.99994	43	77.1
94	0.52635	317972	0.0386	0.99993	43	82.8

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
95	0.52635	317973	0.0387	0.99992	43	78.8
96	0.52661	317537	0.0387	0.99993	43	77.0
97	0.52665	317470	0.0389	0.99994	43	78.3
98	0.52656	317620	0.0390	0.99992	43	82.0
99	0.52673	317352	0.0391	0.99992	43	77.8
100	0.52643	317844	0.0391	0.99992	43	80.5
101	0.52692	317029	0.0393	0.99993	43	82.6
102	0.52677	317284	0.0393	0.99992	43	78.4
103	0.52701	316893	0.0394	0.99994	43	76.8
104	0.52708	316767	0.0396	0.99993	43	82.3
105	0.52694	317002	0.0397	0.99992	43	78.2
106	0.52706	316811	0.0397	0.99991	42	77.6
107	0.52724	316508	0.0398	0.99992	43	80.8
108	0.52748	316118	0.0399	0.99993	43	82.6
109	0.52742	316212	0.0400	0.99992	43	78.3
110	0.52737	316290	0.0400	0.99993	43	77.6
111	0.52717	316618	0.0401	0.99993	43	77.4
112	0.52743	316205	0.0402	0.99991	42	77.4
113	0.52775	315674	0.0403	0.99992	42	76.9
114	0.52758	315944	0.0403	0.99993	42	81.5
115	0.52810	315104	0.0404	0.99993	43	77.8
116	0.52798	315302	0.0404	0.99991	42	77.7
117	0.52790	315433	0.0405	0.99994	43	80.4
118	0.52817	314991	0.0407	0.99993	44	82.7
119	0.52801	315252	0.0408	0.99991	43	77.5
120	0.52823	314894	0.0408	0.99992	42	77.6
121	0.52813	315054	0.0409	0.99993	43	80.5
122	0.52857	314338	0.0409	0.99991	43	77.9
123	0.52802	315229	0.0410	0.99991	43	81.9
124	0.52825	314854	0.0411	0.99992	43	80.4
125	0.52874	314056	0.0411	0.99991	42	77.9
126	0.52842	314574	0.0413	0.99992	43	82.4
127	0.52820	314941	0.0414	0.99990	44	80.9
128	0.52837	314669	0.0415	0.99993	43	81.3
129	0.52881	313939	0.0415	0.99993	43	77.2
130	0.52863	314233	0.0416	0.99991	42	79.9
131	0.52893	313755	0.0418	0.99991	44	81.7
132	0.52920	313313	0.0418	0.99993	43	81.8
133	0.52882	313927	0.0419	0.99992	42	81.3
134	0.52883	313912	0.0420	0.99992	42	79.8
135	0.52914	313399	0.0420	0.99993	43	81.5
136	0.52917	313354	0.0421	0.99992	43	81.2
137	0.52975	312417	0.0422	0.99992	44	81.8
138	0.52943	312934	0.0422	0.99994	43	81.7
139	0.52946	312883	0.0424	0.99991	45	86.2
140	0.52968	312531	0.0425	0.99993	43	77.2
141	0.52942	312957	0.0427	0.99992	43	81.8
142	0.52941	312973	0.0428	0.99992	43	81.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
143	0.53037	311416	0.0429	0.99992	44	80.7
144	0.53014	311782	0.0430	0.99992	43	82.2
145	0.53019	311709	0.0431	0.99994	43	82.0
146	0.53010	311845	0.0431	0.99993	44	80.1
147	0.53011	311838	0.0433	0.99992	44	81.8
148	0.53013	311802	0.0433	0.99994	43	81.8
149	0.53041	311346	0.0434	0.99992	44	80.1
150	0.53011	311823	0.0436	0.99991	44	81.2
151	0.53033	311475	0.0436	0.99992	43	81.6
152	0.53059	311053	0.0437	0.99993	43	81.7
153	0.53043	311316	0.0437	0.99992	44	81.3
154	0.53066	310936	0.0438	0.99993	42	81.3
155	0.53104	310329	0.0438	0.99993	44	80.3
156	0.53102	310354	0.0440	0.99994	44	85.7
157	0.53112	310198	0.0441	0.99993	44	81.7
158	0.53104	310324	0.0442	0.99994	43	81.3
159	0.53116	310131	0.0443	0.99992	44	80.4
160	0.53114	310165	0.0443	0.99992	42	80.9
161	0.53139	309756	0.0445	0.99991	44	82.3
162	0.53148	309615	0.0446	0.99993	44	80.5
163	0.53164	309359	0.0447	0.99994	43	81.3
164	0.53140	309752	0.0447	0.99992	43	82.2
165	0.53145	309657	0.0448	0.99993	44	79.9
166	0.53186	309003	0.0449	0.99992	43	81.4
167	0.53219	308464	0.0451	0.99991	44	82.8
168	0.53220	308461	0.0452	0.99992	44	81.8
169	0.53146	309653	0.0452	0.99993	43	81.2
170	0.53179	309108	0.0453	0.99991	42	81.2
171	0.53187	308990	0.0454	0.99992	44	85.0
172	0.53199	308793	0.0455	0.99992	43	81.6
173	0.53195	308855	0.0457	0.99992	44	82.1
174	0.53219	308469	0.0458	0.99993	44	80.4
175	0.53230	308301	0.0459	0.99992	44	81.6
176	0.53215	308543	0.0460	0.99993	42	81.4
177	0.53267	307692	0.0460	0.99993	44	80.3
178	0.53278	307528	0.0461	0.99992	42	82.1
179	0.53268	307683	0.0463	0.99993	44	82.1
180	0.53277	307533	0.0463	0.99993	44	84.6
181	0.53283	307446	0.0464	0.99992	44	81.5
182	0.53303	307129	0.0466	0.99992	44	87.0
183	0.53268	307689	0.0467	0.99993	44	84.8
184	0.53306	307069	0.0469	0.99992	44	82.2
185	0.53299	307187	0.0469	0.99993	43	81.7
186	0.53302	307143	0.0471	0.99992	44	81.4
187	0.53320	306844	0.0471	0.99994	44	81.4
188	0.53317	306890	0.0473	0.99992	44	86.1
189	0.53363	306159	0.0474	0.99993	44	85.3
190	0.53312	306972	0.0475	0.99991	44	81.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
191	0.53313	306962	0.0475	0.99993	42	81.2
192	0.53375	305976	0.0476	0.99994	44	80.2
193	0.53352	306332	0.0478	0.99991	44	86.4
194	0.53389	305748	0.0479	0.99993	44	82.3
195	0.53387	305771	0.0479	0.99993	43	81.0
196	0.53422	305217	0.0480	0.99994	43	81.4
197	0.53399	305587	0.0482	0.99993	45	85.9
198	0.53379	305903	0.0482	0.99993	44	81.2
199	0.53437	304986	0.0484	0.99993	44	86.8
200	0.53422	305217	0.0485	0.99993	44	85.3
201	0.53423	305197	0.0486	0.99993	43	82.1
202	0.53408	305437	0.0487	0.99992	44	86.5
203	0.53432	305053	0.0488	0.99993	44	84.8
204	0.53460	304605	0.0490	0.99992	44	86.3
205	0.53432	305054	0.0490	0.99991	44	82.0
206	0.53432	305064	0.0491	0.99992	44	84.4
207	0.53460	304608	0.0493	0.99993	44	87.0
208	0.53441	304916	0.0494	0.99992	44	81.3
209	0.53445	304845	0.0495	0.99993	44	84.7
210	0.53468	304481	0.0495	0.99991	44	82.1
211	0.53486	304198	0.0497	0.99992	44	86.6
212	0.53481	304277	0.0498	0.99993	44	86.2
213	0.53506	303873	0.0498	0.99993	44	81.4
214	0.53497	304025	0.0500	0.99992	45	86.3
215	0.53544	303283	0.0501	0.99994	44	81.8
216	0.53514	303760	0.0503	0.99992	44	86.6
217	0.53539	303354	0.0504	0.99993	44	85.5
218	0.53541	303329	0.0505	0.99993	44	87.1
219	0.53571	302844	0.0506	0.99993	44	82.3
220	0.53530	303499	0.0507	0.99993	44	84.4
221	0.53585	302618	0.0507	0.99993	44	81.9
222	0.53534	303429	0.0508	0.99993	43	81.1
223	0.53566	302922	0.0509	0.99994	44	85.7
224	0.53611	302212	0.0509	0.99993	44	82.0
225	0.53526	303567	0.0511	0.99993	45	86.0
226	0.53593	302497	0.0512	0.99991	43	81.7
227	0.53507	303861	0.0514	0.99986	44	86.4
228	0.53551	303161	0.0515	0.99990	44	85.3
229	0.53603	302332	0.0516	0.99991	44	86.0
230	0.53626	301975	0.0518	0.99992	44	86.7
231	0.53608	302262	0.0518	0.99991	44	84.6
232	0.53629	301931	0.0519	0.99991	44	81.3
233	0.53628	301938	0.0521	0.99993	44	86.9
234	0.53679	301143	0.0522	0.99993	44	85.1
235	0.53672	301249	0.0523	0.99993	44	86.4
236	0.53699	300824	0.0523	0.99992	43	82.4
237	0.53695	300886	0.0524	0.99993	44	82.1
238	0.53755	299941	0.0524	0.99993	43	82.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
239	0.53722	300457	0.0526	0.99994	44	87.7
240	0.53723	300446	0.0527	0.99994	44	86.7
241	0.53744	300104	0.0528	0.99994	44	86.4
242	0.53740	300165	0.0529	0.99994	44	85.4
243	0.53745	300087	0.0530	0.99992	44	87.1
244	0.53780	299548	0.0531	0.99993	44	86.7
245	0.53772	299672	0.0532	0.99995	44	87.1
246	0.53800	299222	0.0532	0.99994	44	82.6
247	0.53804	299161	0.0534	0.99992	44	87.8
248	0.53765	299784	0.0535	0.99992	44	86.6
249	0.53820	298913	0.0536	0.99994	44	82.4
250	0.53848	298477	0.0537	0.99994	44	85.5
251	0.53814	299011	0.0538	0.99992	44	86.4
252	0.53828	298790	0.0539	0.99991	44	86.8
253	0.53832	298717	0.0540	0.99993	44	85.2
254	0.53844	298540	0.0541	0.99992	44	88.2
255	0.53877	298011	0.0541	0.99992	44	82.8
256	0.53819	298933	0.0542	0.99993	43	84.8
257	0.53852	298407	0.0543	0.99991	44	87.3
258	0.53867	298168	0.0544	0.99992	43	82.2
259	0.53851	298419	0.0546	0.99993	44	85.6
260	0.53881	297961	0.0546	0.99992	43	86.4
261	0.53868	298155	0.0548	0.99989	46	86.7
262	0.53895	297729	0.0550	0.99992	44	87.5
263	0.53875	298049	0.0550	0.99991	44	86.8
264	0.53875	298051	0.0553	0.99989	46	87.1
265	0.53872	298093	0.0553	0.99991	44	82.1
266	0.53872	298098	0.0554	0.99990	44	82.9
267	0.53932	297148	0.0554	0.99990	43	85.3
268	0.53936	297091	0.0556	0.99989	44	86.7
269	0.53951	296861	0.0556	0.99991	44	85.8
270	0.53886	297883	0.0557	0.99989	44	85.0
271	0.53940	297033	0.0558	0.99991	44	86.3
272	0.53967	296613	0.0558	0.99991	44	82.6
273	0.53933	297134	0.0559	0.99990	43	84.8
274	0.53920	297340	0.0560	0.99988	44	86.3
275	0.53933	297136	0.0562	0.99991	45	87.1
276	0.53946	296941	0.0563	0.99989	45	86.9
277	0.53990	296251	0.0564	0.99991	44	87.1
278	0.53920	297349	0.0566	0.99987	46	91.3
279	0.53929	297209	0.0567	0.99990	44	82.4
280	0.53984	296342	0.0569	0.99991	44	87.6
281	0.53952	296840	0.0570	0.99991	45	85.6
282	0.53960	296710	0.0571	0.99992	44	87.3
283	0.53986	296315	0.0572	0.99994	44	87.0
284	0.53943	296986	0.0573	0.99992	44	85.1
285	0.54013	295887	0.0575	0.99992	44	87.3
286	0.53978	296435	0.0575	0.99994	44	86.7

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
287	0.54028	295652	0.0576	0.99992	45	86.2
288	0.54005	296015	0.0577	0.99993	44	86.2
289	0.54034	295563	0.0578	0.99992	45	85.3
290	0.54035	295540	0.0580	0.99993	44	87.2
291	0.54066	295061	0.0580	0.99993	44	86.6
292	0.54066	295068	0.0581	0.99992	45	85.4
293	0.54079	294863	0.0582	0.99993	43	86.4
294	0.54093	294641	0.0584	0.99991	45	87.2
295	0.54070	295001	0.0584	0.99993	43	86.8
296	0.54083	294797	0.0586	0.99993	44	87.8
297	0.54111	294360	0.0587	0.99993	45	85.7
298	0.54096	294589	0.0589	0.99992	44	87.5
299	0.54088	294719	0.0589	0.99992	44	87.0
300	0.54131	294053	0.0590	0.99995	44	87.1
301	0.54103	294479	0.0592	0.99992	44	88.3
302	0.54131	294053	0.0592	0.99992	45	85.7
303	0.54134	293997	0.0595	0.99990	45	87.6
304	0.54146	293811	0.0595	0.99994	44	86.8
305	0.54148	293782	0.0596	0.99992	45	85.9
306	0.54136	293967	0.0598	0.99993	44	87.4
307	0.54145	293840	0.0598	0.99991	44	87.4
308	0.54182	293260	0.0599	0.99992	45	85.3
309	0.54161	293588	0.0601	0.99993	44	87.9
310	0.54182	293253	0.0602	0.99991	45	91.8
311	0.54212	292793	0.0604	0.99991	45	88.1
312	0.54205	292909	0.0605	0.99992	44	87.7
313	0.54228	292539	0.0606	0.99993	45	85.7
314	0.54199	292997	0.0607	0.99992	44	87.7
315	0.54233	292471	0.0607	0.99992	43	87.0
316	0.54230	292523	0.0608	0.99994	44	86.7
317	0.54206	292890	0.0609	0.99993	44	86.5
318	0.54210	292825	0.0610	0.99991	44	87.4
319	0.54302	291396	0.0611	0.99993	44	86.8
320	0.54250	292203	0.0611	0.99992	44	87.0
321	0.54255	292127	0.0613	0.99992	46	91.6
322	0.54266	291964	0.0614	0.99991	44	87.1
323	0.54279	291752	0.0616	0.99993	44	87.9
324	0.54314	291224	0.0617	0.99993	45	86.6
325	0.54287	291639	0.0617	0.99994	44	87.1
326	0.54267	291937	0.0619	0.99990	45	92.1
327	0.54314	291217	0.0621	0.99992	45	91.6
328	0.54322	291098	0.0621	0.99992	44	88.0
329	0.54308	291304	0.0623	0.99992	45	92.5
330	0.54327	291014	0.0625	0.99992	45	88.4
331	0.54319	291143	0.0625	0.99993	44	87.7
332	0.54346	290720	0.0627	0.99993	45	91.1
333	0.54337	290863	0.0628	0.99993	45	88.2
334	0.54341	290799	0.0629	0.99993	44	87.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
335	0.54361	290490	0.0630	0.99993	45	86.2
336	0.54314	291221	0.0630	0.99993	44	87.0
337	0.54345	290740	0.0632	0.99993	45	91.9
338	0.54352	290637	0.0634	0.99993	44	88.2
339	0.54335	290887	0.0635	0.99993	44	88.0
340	0.54365	290426	0.0635	0.99991	45	86.0
341	0.54372	290315	0.0637	0.99993	44	88.3
342	0.54374	290293	0.0637	0.99993	44	87.9
343	0.54413	289696	0.0638	0.99992	45	87.4
344	0.54401	289873	0.0639	0.99992	43	87.5
345	0.54397	289940	0.0641	0.99992	46	93.3
346	0.54381	290187	0.0642	0.99993	44	88.9
347	0.54395	289967	0.0644	0.99993	44	88.4
348	0.54419	289594	0.0645	0.99991	45	87.6
349	0.54402	289864	0.0645	0.99991	43	87.7
350	0.54453	289077	0.0646	0.99992	44	86.0
351	0.54439	289293	0.0647	0.99990	45	87.9
352	0.54443	289232	0.0648	0.99993	44	87.7
353	0.54456	289033	0.0648	0.99990	44	85.9
354	0.54491	288498	0.0649	0.99992	44	88.8
355	0.54445	289202	0.0651	0.99993	44	88.8
356	0.54474	288751	0.0652	0.99992	45	87.5
357	0.54485	288583	0.0652	0.99993	43	88.1
358	0.54473	288775	0.0653	0.99992	44	86.0
359	0.54495	288430	0.0655	0.99992	45	88.0
360	0.54514	288145	0.0655	0.99994	44	87.8
361	0.54499	288377	0.0656	0.99991	45	88.0
362	0.54517	288102	0.0657	0.99992	44	87.5
363	0.54512	288167	0.0659	0.99990	46	92.5
364	0.54538	287781	0.0661	0.99991	46	93.8
365	0.54522	288013	0.0662	0.99992	44	88.6
366	0.54521	288028	0.0662	0.99993	44	87.8
367	0.54567	287333	0.0664	0.99992	45	93.6
368	0.54563	287392	0.0665	0.99993	45	91.9
369	0.54574	287225	0.0665	0.99994	44	88.0
370	0.54583	287089	0.0668	0.99994	45	88.9
371	0.54553	287550	0.0668	0.99992	45	92.8
372	0.54563	287394	0.0669	0.99992	44	87.8
373	0.54571	287276	0.0671	0.99991	46	92.3
374	0.54598	286861	0.0673	0.99990	46	94.4
375	0.54577	287176	0.0674	0.99992	44	88.7
376	0.54554	287527	0.0675	0.99992	45	91.1
377	0.54602	286799	0.0675	0.99993	44	88.1
378	0.54622	286489	0.0676	0.99993	44	86.5
379	0.54644	286150	0.0678	0.99992	45	88.4
380	0.54657	285959	0.0678	0.99993	44	88.3
381	0.54640	286215	0.0679	0.99993	45	86.6
382	0.54641	286208	0.0681	0.99991	46	93.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
383	0.54633	286325	0.0683	0.99990	45	92.0
384	0.54644	286160	0.0684	0.99991	43	91.6
385	0.54669	285779	0.0686	0.99992	43	91.2
386	0.54697	285351	0.0686	0.99993	44	86.7
387	0.54726	284905	0.0688	0.99993	45	94.2
388	0.54689	285470	0.0689	0.99991	45	91.9
389	0.54702	285267	0.0690	0.99991	45	93.6
390	0.54666	285826	0.0691	0.99991	44	88.9
391	0.54676	285669	0.0692	0.99992	45	88.5
392	0.54682	285570	0.0693	0.99994	44	88.4
393	0.54703	285263	0.0693	0.99993	45	86.6
394	0.54764	284334	0.0695	0.99993	45	88.8
395	0.54709	285163	0.0695	0.99992	44	88.2
396	0.54729	284868	0.0696	0.99993	45	87.9
397	0.54734	284788	0.0698	0.99991	45	94.6
398	0.54740	284694	0.0700	0.99993	45	93.8
399	0.54748	284576	0.0700	0.99991	45	88.1
400	0.54766	284294	0.0701	0.99993	45	91.7
401	0.54779	284098	0.0703	0.99992	45	89.5
402	0.54776	284145	0.0703	0.99993	44	88.5
403	0.54781	284075	0.0704	0.99993	45	88.2
404	0.54811	283617	0.0706	0.99990	45	95.3
405	0.54809	283650	0.0708	0.99993	45	94.3
406	0.54806	283695	0.0708	0.99993	44	89.1
407	0.54822	283448	0.0711	0.99992	46	93.9
408	0.54819	283503	0.0712	0.99991	45	94.1
409	0.54850	283031	0.0713	0.99993	45	88.5
410	0.54815	283561	0.0714	0.99992	45	88.8
411	0.54849	283036	0.0714	0.99991	43	88.9
412	0.54842	283146	0.0715	0.99992	44	91.5
413	0.54847	283075	0.0716	0.99991	45	88.8
414	0.54864	282815	0.0718	0.99993	46	94.2
415	0.54863	282832	0.0719	0.99990	45	90.4
416	0.54906	282189	0.0721	0.99992	45	94.9
417	0.54847	283071	0.0722	0.99992	45	92.1
418	0.54908	282146	0.0722	0.99991	45	89.2
419	0.54939	281691	0.0724	0.99992	45	94.6
420	0.54907	282172	0.0726	0.99990	45	93.6
421	0.54941	281659	0.0726	0.99991	45	89.4
422	0.54915	282051	0.0727	0.99991	45	92.2
423	0.54916	282029	0.0728	0.99991	44	88.6
424	0.54915	282048	0.0730	0.99991	46	93.7
425	0.54935	281738	0.0732	0.99991	46	95.0
426	0.54964	281309	0.0733	0.99993	45	89.1
427	0.54961	281353	0.0734	0.99992	45	92.6
428	0.54963	281318	0.0734	0.99993	45	88.7
429	0.54947	281558	0.0735	0.99993	45	92.1
430	0.54963	281329	0.0737	0.99993	45	93.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
431	0.54981	281054	0.0737	0.99990	44	89.0
432	0.54979	281088	0.0738	0.99992	45	93.3
433	0.55018	280499	0.0740	0.99992	45	95.9
434	0.55021	280457	0.0741	0.99993	45	92.7
435	0.54998	280797	0.0741	0.99994	44	89.8
436	0.55002	280739	0.0743	0.99992	45	93.6
437	0.55000	280772	0.0744	0.99993	45	93.9
438	0.55037	280212	0.0746	0.99993	46	95.1
439	0.54993	280868	0.0747	0.99992	45	93.5
440	0.55030	280319	0.0747	0.99992	44	88.3
441	0.55027	280360	0.0748	0.99991	45	92.4
442	0.55047	280060	0.0749	0.99991	45	89.8
443	0.55032	280286	0.0750	0.99994	45	92.6
444	0.55029	280333	0.0751	0.99991	45	93.4
445	0.55054	279951	0.0752	0.99994	45	92.6
446	0.55088	279446	0.0754	0.99992	45	94.8
447	0.55113	279074	0.0754	0.99994	45	93.4
448	0.55055	279940	0.0755	0.99992	45	93.1
449	0.55065	279783	0.0756	0.99992	45	93.8
450	0.55110	279119	0.0757	0.99993	45	93.8
451	0.55088	279438	0.0759	0.99991	45	95.3
452	0.55099	279275	0.0760	0.99992	45	93.9
453	0.55121	278947	0.0761	0.99992	45	93.9
454	0.55086	279474	0.0763	0.99990	46	94.7
455	0.55108	279148	0.0765	0.99992	45	95.2
456	0.55127	278864	0.0766	0.99992	45	89.6
457	0.55106	279172	0.0767	0.99992	45	94.2
458	0.55142	278636	0.0769	0.99993	45	94.9
459	0.55160	278372	0.0770	0.99994	45	95.0
460	0.55140	278670	0.0772	0.99991	45	95.0
461	0.55140	278659	0.0773	0.99992	45	93.1
462	0.55176	278124	0.0775	0.99992	45	94.9
463	0.55178	278104	0.0775	0.99994	45	89.7
464	0.55208	277649	0.0777	0.99992	45	94.7
465	0.55192	277893	0.0777	0.99992	44	93.3
466	0.55194	277865	0.0778	0.99992	45	93.7
467	0.55206	277681	0.0778	0.99993	45	94.0
468	0.55192	277883	0.0781	0.99992	46	93.8
469	0.55227	277366	0.0781	0.99993	45	94.6
470	0.55155	278444	0.0783	0.99993	46	93.8
471	0.55239	277193	0.0784	0.99991	45	94.3
472	0.55210	277623	0.0786	0.99993	45	94.3
473	0.55232	277285	0.0788	0.99992	45	94.9
474	0.55239	277191	0.0788	0.99994	45	89.9
475	0.55246	277089	0.0791	0.99992	46	95.4
476	0.55244	277112	0.0791	0.99992	45	94.4
477	0.55273	276685	0.0793	0.99992	46	99.4
478	0.55284	276522	0.0794	0.99993	45	94.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
479	0.55259	276889	0.0795	0.99992	45	93.6
480	0.55291	276409	0.0795	0.99993	45	93.7
481	0.55289	276449	0.0796	0.99994	45	93.6
482	0.55299	276288	0.0797	0.99993	45	94.2
483	0.55277	276620	0.0799	0.99991	45	95.4
484	0.55293	276382	0.0800	0.99992	45	94.4
485	0.55314	276068	0.0801	0.99993	45	94.4
486	0.55302	276244	0.0802	0.99991	45	92.7
487	0.55315	276050	0.0803	0.99991	45	94.5
488	0.55342	275653	0.0804	0.99992	45	93.4
489	0.55321	275963	0.0806	0.99991	45	94.9
490	0.55330	275830	0.0806	0.99993	45	94.1
491	0.55355	275459	0.0807	0.99991	45	94.3
492	0.55326	275892	0.0810	0.99992	45	94.9
493	0.55352	275514	0.0811	0.99992	46	95.7
494	0.55369	275258	0.0812	0.99992	45	94.2
495	0.55341	275674	0.0812	0.99992	44	93.6
496	0.55351	275523	0.0815	0.99992	45	95.1
497	0.55380	275096	0.0816	0.99993	45	93.0
498	0.55365	275313	0.0817	0.99991	45	94.4
499	0.55400	274792	0.0818	0.99993	45	94.7
500	0.55426	274410	0.0819	0.99992	45	94.1
501	0.55423	274458	0.0819	0.99993	45	94.4
502	0.55403	274755	0.0820	0.99992	45	94.0
503	0.55412	274617	0.0821	0.99992	44	94.2
504	0.55417	274549	0.0823	0.99989	46	94.9
505	0.55422	274464	0.0824	0.99992	45	94.4
506	0.55437	274247	0.0825	0.99993	45	93.1
507	0.55436	274264	0.0826	0.99987	45	95.4
508	0.55469	273774	0.0827	0.99986	46	93.5
509	0.55431	274330	0.0828	0.99989	45	95.1
510	0.55462	273885	0.0828	0.99991	45	94.7
511	0.55466	273814	0.0830	0.99991	44	93.8
512	0.55487	273514	0.0832	0.99990	45	96.6
513	0.55531	272865	0.0833	0.99991	45	94.7
514	0.55523	272978	0.0835	0.99992	45	96.0
515	0.55556	272485	0.0837	0.99992	46	99.6
516	0.55553	272531	0.0837	0.99992	45	94.9
517	0.55570	272283	0.0840	0.99991	47	100.5
518	0.55586	272054	0.0842	0.99993	45	96.5
519	0.55583	272088	0.0842	0.99993	46	94.5
520	0.55620	271550	0.0845	0.99992	45	96.2
521	0.55596	271909	0.0845	0.99992	45	95.3
522	0.55581	272125	0.0846	0.99992	45	95.4
523	0.55613	271658	0.0848	0.99992	45	95.8
524	0.55612	271663	0.0849	0.99992	45	95.4
525	0.55641	271248	0.0850	0.99991	45	94.6
526	0.55615	271627	0.0850	0.99992	45	94.7

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
527	0.55653	271071	0.0852	0.99992	45	96.3
528	0.55686	270575	0.0853	0.99992	46	94.5
529	0.55688	270549	0.0854	0.99993	45	95.4
530	0.55706	270289	0.0856	0.99991	46	98.9
531	0.55682	270647	0.0857	0.99991	45	95.9
532	0.55713	270181	0.0858	0.99992	45	95.4
533	0.55716	270148	0.0858	0.99993	45	94.7
534	0.55716	270149	0.0861	0.99992	46	96.6
535	0.55730	269936	0.0862	0.99992	46	94.8
536	0.55725	270003	0.0862	0.99992	45	95.3
537	0.55726	269989	0.0863	0.99991	46	98.8
538	0.55738	269825	0.0865	0.99990	45	95.5
539	0.55735	269863	0.0865	0.99990	46	99.4
540	0.55697	270416	0.0867	0.99991	45	95.6
541	0.55735	269864	0.0867	0.99990	45	95.9
542	0.55741	269782	0.0870	0.99987	45	96.3
543	0.55730	269931	0.0871	0.99989	45	95.6
544	0.55749	269663	0.0872	0.99989	46	95.5
545	0.55753	269597	0.0872	0.99991	45	95.5
546	0.55765	269430	0.0875	0.99988	46	100.9
547	0.55750	269648	0.0875	0.99990	45	95.1
548	0.55792	269028	0.0877	0.99990	46	94.0
549	0.55786	269117	0.0878	0.99988	45	95.9
550	0.55807	268806	0.0878	0.99989	46	93.9
551	0.55783	269161	0.0880	0.99986	45	96.3
552	0.55781	269186	0.0881	0.99988	45	95.5
553	0.55812	268735	0.0882	0.99988	45	95.1
554	0.55797	268956	0.0884	0.99989	45	96.6
555	0.55812	268744	0.0885	0.99988	46	95.7
556	0.55780	269202	0.0885	0.99989	45	94.7
557	0.55867	267931	0.0886	0.99989	46	95.5
558	0.55805	268847	0.0889	0.99992	46	97.3
559	0.55810	268769	0.0890	0.99992	46	99.7
560	0.55817	268667	0.0892	0.99991	46	95.2
561	0.55852	268153	0.0892	0.99992	46	99.3
562	0.55825	268553	0.0894	0.99992	45	95.5
563	0.55864	267983	0.0895	0.99992	45	97.0
564	0.55855	268118	0.0897	0.99992	45	96.3
565	0.55857	268090	0.0897	0.99993	45	96.0
566	0.55876	267805	0.0898	0.99993	45	95.1
567	0.55857	268089	0.0901	0.99992	46	101.7
568	0.55894	267549	0.0901	0.99991	46	95.1
569	0.55868	267918	0.0902	0.99992	45	95.8
570	0.55905	267380	0.0903	0.99992	46	95.5
571	0.55872	267864	0.0905	0.99991	45	97.1
572	0.55942	266848	0.0906	0.99989	46	95.9
573	0.55870	267889	0.0907	0.99993	45	96.0
574	0.55915	267236	0.0908	0.99990	46	94.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
575	0.55902	267422	0.0910	0.99992	45	96.4
576	0.55921	267147	0.0910	0.99992	46	94.6
577	0.55927	267065	0.0912	0.99992	45	96.2
578	0.55926	267078	0.0914	0.99991	46	101.2
579	0.55933	266974	0.0915	0.99992	45	96.3
580	0.55943	266827	0.0915	0.99993	45	95.6
581	0.55927	267066	0.0917	0.99992	45	95.6
582	0.55969	266457	0.0919	0.99990	47	101.8
583	0.55993	266111	0.0920	0.99991	46	96.4
584	0.55967	266485	0.0921	0.99992	45	96.2
585	0.55959	266603	0.0921	0.99991	46	95.0
586	0.55990	266149	0.0924	0.99990	46	102.3
587	0.55982	266264	0.0924	0.99990	46	95.4
588	0.56008	265896	0.0925	0.99993	45	96.5
589	0.56005	265941	0.0926	0.99993	46	94.9
590	0.56016	265776	0.0928	0.99990	46	101.9
591	0.55990	266154	0.0929	0.99991	46	99.0
592	0.56038	265455	0.0931	0.99992	47	102.3
593	0.56040	265433	0.0932	0.99992	46	99.3
594	0.56052	265251	0.0934	0.99992	47	102.4
595	0.56048	265317	0.0936	0.99991	46	100.2
596	0.56082	264816	0.0937	0.99991	46	102.2
597	0.56056	265201	0.0938	0.99991	46	99.5
598	0.56079	264862	0.0940	0.99992	46	96.4
599	0.56107	264458	0.0941	0.99993	46	100.3
600	0.56091	264685	0.0942	0.99990	46	96.6
601	0.56064	265081	0.0942	0.99993	45	95.4
602	0.56111	264401	0.0944	0.99990	46	100.8
603	0.56092	264684	0.0946	0.99992	46	102.4
604	0.56177	263449	0.0947	0.99991	46	102.2
605	0.56137	264031	0.0948	0.99991	46	95.5
606	0.56133	264089	0.0949	0.99993	46	96.4
607	0.56170	263559	0.0950	0.99993	46	96.5
608	0.56149	263853	0.0951	0.99992	46	96.1
609	0.56160	263698	0.0953	0.99991	46	103.1
610	0.56154	263782	0.0955	0.99990	46	101.0
611	0.56178	263440	0.0957	0.99991	47	103.2
612	0.56161	263679	0.0958	0.99991	46	97.0
613	0.56147	263883	0.0960	0.99991	45	102.9
614	0.56193	263227	0.0961	0.99991	46	101.4
615	0.56184	263350	0.0962	0.99991	45	96.3
616	0.56205	263051	0.0964	0.99990	47	101.5
617	0.56199	263130	0.0965	0.99991	45	97.8
618	0.56220	262832	0.0966	0.99991	46	100.6
619	0.56232	262659	0.0969	0.99992	47	103.0
620	0.56239	262555	0.0969	0.99992	46	100.8
621	0.56259	262267	0.0971	0.99991	46	102.2
622	0.56226	262752	0.0973	0.99990	47	102.1

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
623	0.56235	262618	0.0975	0.99989	47	102.4
624	0.56242	262522	0.0977	0.99990	46	101.0
625	0.56266	262177	0.0979	0.99991	46	103.0
626	0.56270	262109	0.0980	0.99990	46	100.5
627	0.56271	262098	0.0982	0.99989	47	103.2
628	0.56260	262255	0.0983	0.99989	46	101.4
629	0.56317	261444	0.0986	0.99991	46	103.3
630	0.56317	261444	0.0987	0.99991	46	102.1
631	0.56336	261173	0.0987	0.99991	46	96.4
632	0.56326	261320	0.0989	0.99991	46	97.3
633	0.56329	261269	0.0991	0.99992	46	103.3
634	0.56342	261082	0.0992	0.99990	46	100.3
635	0.56356	260888	0.0993	0.99991	46	102.4
636	0.56348	261006	0.0994	0.99991	46	100.6
637	0.56369	260701	0.0996	0.99991	46	102.0
638	0.56386	260461	0.0996	0.99992	46	100.6
639	0.56389	260421	0.0997	0.99990	46	97.0
640	0.56380	260540	0.0998	0.99991	46	100.3
641	0.56402	260228	0.1000	0.99991	46	103.1
642	0.56405	260185	0.1000	0.99993	46	100.2
643	0.56397	260302	0.1002	0.99990	46	102.2
644	0.56400	260264	0.1004	0.99990	47	102.7
645	0.56438	259718	0.1007	0.99991	46	103.1
646	0.56441	259675	0.1007	0.99992	46	100.9
647	0.56441	259680	0.1008	0.99991	46	97.9
648	0.56469	259275	0.1010	0.99993	46	103.4
649	0.56500	258839	0.1011	0.99993	46	102.8
650	0.56472	259230	0.1013	0.99990	47	103.4
651	0.56501	258816	0.1014	0.99991	46	102.5
652	0.56479	259130	0.1016	0.99991	47	103.7
653	0.56504	258783	0.1017	0.99991	46	102.8
654	0.56480	259123	0.1020	0.99991	46	103.6
655	0.56498	258859	0.1021	0.99990	46	103.4
656	0.56526	258466	0.1023	0.99991	47	103.3
657	0.56547	258172	0.1024	0.99991	46	103.2
658	0.56539	258286	0.1027	0.99992	47	103.5
659	0.56538	258293	0.1028	0.99992	46	103.0
660	0.56549	258140	0.1030	0.99992	46	103.6
661	0.56586	257609	0.1031	0.99991	46	103.4
662	0.56552	258099	0.1032	0.99990	46	102.6
663	0.56574	257785	0.1034	0.99992	47	104.0
664	0.56589	257565	0.1035	0.99993	46	102.5
665	0.56598	257441	0.1036	0.99992	46	102.4
666	0.56611	257264	0.1038	0.99991	46	103.2
667	0.56620	257129	0.1039	0.99990	46	103.0
668	0.56652	256675	0.1042	0.99990	47	104.7
669	0.56659	256584	0.1043	0.99991	46	103.1
670	0.56665	256492	0.1043	0.99991	46	103.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
671	0.56652	256682	0.1046	0.99991	47	104.9
672	0.56645	256785	0.1049	0.99990	47	104.7
673	0.56695	256079	0.1051	0.99992	46	104.7
674	0.56679	256305	0.1053	0.99993	47	104.7
675	0.56722	255694	0.1054	0.99991	46	103.3
676	0.56711	255854	0.1056	0.99991	47	103.7
677	0.56710	255855	0.1059	0.99990	46	104.6
678	0.56732	255548	0.1060	0.99994	46	103.1
679	0.56721	255709	0.1061	0.99991	46	102.7
680	0.56727	255618	0.1063	0.99991	47	104.9
681	0.56775	254944	0.1064	0.99993	46	103.6
682	0.56747	255345	0.1066	0.99991	47	103.6
683	0.56785	254800	0.1067	0.99992	46	103.9
684	0.56770	255012	0.1070	0.99990	47	104.3
685	0.56794	254675	0.1072	0.99992	47	105.5
686	0.56750	255299	0.1073	0.99992	46	101.7
687	0.56801	254586	0.1075	0.99991	46	103.8
688	0.56803	254555	0.1076	0.99993	46	101.9
689	0.56823	254274	0.1078	0.99993	46	104.1
690	0.56833	254126	0.1080	0.99991	47	104.1
691	0.56811	254438	0.1082	0.99991	47	104.7
692	0.56842	254009	0.1084	0.99992	47	104.7
693	0.56863	253706	0.1086	0.99992	46	100.1
694	0.56855	253817	0.1088	0.99993	47	105.3
695	0.56861	253733	0.1090	0.99992	47	104.7
696	0.56847	253940	0.1091	0.99992	46	101.9
697	0.56879	253493	0.1093	0.99993	47	104.5
698	0.56898	253218	0.1094	0.99994	46	102.3
699	0.56890	253328	0.1097	0.99992	47	106.7
700	0.56874	253556	0.1099	0.99989	47	103.9
701	0.56934	252709	0.1100	0.99992	46	105.1
702	0.56933	252736	0.1101	0.99993	46	102.0
703	0.56933	252727	0.1104	0.99992	47	105.3
704	0.56935	252696	0.1105	0.99993	46	102.9
705	0.56926	252825	0.1106	0.99992	46	104.5
706	0.56925	252846	0.1108	0.99990	47	105.0
707	0.56950	252487	0.1111	0.99991	46	104.9
708	0.56926	252825	0.1112	0.99992	47	103.3
709	0.56968	252242	0.1115	0.99992	47	104.8
710	0.56999	251810	0.1116	0.99993	46	102.7
711	0.56996	251853	0.1117	0.99992	46	104.0
712	0.56996	251846	0.1118	0.99992	46	102.3
713	0.56997	251836	0.1120	0.99992	47	104.5
714	0.57009	251667	0.1121	0.99993	46	102.2
715	0.57020	251518	0.1123	0.99992	47	106.1
716	0.57029	251393	0.1125	0.99993	47	105.2
717	0.57064	250904	0.1127	0.99992	47	105.7
718	0.57049	251114	0.1128	0.99992	46	105.1

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
719	0.57074	250762	0.1131	0.99992	47	106.4
720	0.57098	250429	0.1132	0.99992	46	104.8
721	0.57091	250532	0.1134	0.99993	47	105.3
722	0.57105	250337	0.1135	0.99993	46	104.8
723	0.57096	250463	0.1137	0.99993	47	105.9
724	0.57097	250440	0.1138	0.99991	46	104.7
725	0.57098	250428	0.1139	0.99991	46	103.1
726	0.57121	250111	0.1141	0.99992	47	105.5
727	0.57140	249842	0.1142	0.99993	46	104.2
728	0.57200	249018	0.1145	0.99994	47	106.3
729	0.57188	249180	0.1146	0.99994	47	105.4
730	0.57179	249308	0.1149	0.99992	47	106.8
731	0.57224	248687	0.1150	0.99995	46	105.1
732	0.57238	248495	0.1152	0.99994	47	108.6
733	0.57246	248380	0.1153	0.99993	46	105.1
734	0.57267	248087	0.1156	0.99994	47	106.1
735	0.57282	247878	0.1157	0.99993	46	106.0
736	0.57275	247981	0.1159	0.99993	47	106.4
737	0.57314	247438	0.1160	0.99994	46	105.9
738	0.57317	247395	0.1163	0.99993	47	106.5
739	0.57325	247286	0.1165	0.99994	47	107.8
740	0.57321	247340	0.1167	0.99992	47	111.8
741	0.57348	246966	0.1169	0.99993	47	106.4
742	0.57331	247200	0.1171	0.99991	48	112.5
743	0.57364	246753	0.1173	0.99991	46	105.6
744	0.57345	247015	0.1175	0.99992	46	103.6
745	0.57377	246580	0.1176	0.99992	47	106.0
746	0.57380	246537	0.1177	0.99993	46	105.2
747	0.57377	246569	0.1180	0.99990	47	107.2
748	0.57362	246779	0.1182	0.99990	47	105.8
749	0.57415	246058	0.1184	0.99992	47	108.0
750	0.57376	246592	0.1187	0.99989	47	107.5
751	0.57420	245985	0.1190	0.99990	47	107.8
752	0.57425	245919	0.1191	0.99990	47	106.2
753	0.57382	246507	0.1193	0.99989	47	106.5
754	0.57403	246220	0.1194	0.99990	46	106.0
755	0.57404	246198	0.1198	0.99991	47	111.6
756	0.57428	245873	0.1199	0.99990	47	105.8
757	0.57403	246222	0.1200	0.99991	46	104.1
758	0.57442	245683	0.1203	0.99993	47	106.9
759	0.57482	245133	0.1204	0.99993	47	105.6
760	0.57437	245756	0.1206	0.99991	47	106.3
761	0.57448	245599	0.1207	0.99993	46	105.9
762	0.57463	245394	0.1210	0.99993	47	107.1
763	0.57484	245112	0.1211	0.99994	46	106.2
764	0.57476	245210	0.1214	0.99993	47	106.8
765	0.57466	245353	0.1215	0.99993	46	106.0
766	0.57483	245113	0.1217	0.99990	47	107.1

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
767	0.57514	244698	0.1220	0.99992	47	108.2
768	0.57529	244493	0.1223	0.99992	47	108.1
769	0.57506	244809	0.1224	0.99992	46	106.6
770	0.57539	244349	0.1227	0.99992	48	112.0
771	0.57514	244697	0.1229	0.99992	47	106.2
772	0.57542	244306	0.1232	0.99993	47	113.4
773	0.57547	244246	0.1234	0.99993	47	107.3
774	0.57559	244079	0.1236	0.99992	46	105.8
775	0.57535	244409	0.1238	0.99993	47	106.8
776	0.57610	243378	0.1239	0.99994	48	106.5
777	0.57571	243919	0.1242	0.99993	47	106.8
778	0.57580	243799	0.1243	0.99993	47	107.0
779	0.57608	243416	0.1246	0.99993	47	107.0
780	0.57615	243320	0.1247	0.99993	46	106.4
781	0.57619	243263	0.1249	0.99992	47	107.2
782	0.57637	243011	0.1250	0.99993	46	106.4
783	0.57649	242855	0.1253	0.99991	48	111.9
784	0.57659	242717	0.1255	0.99992	47	108.4
785	0.57655	242766	0.1258	0.99992	47	114.1
786	0.57674	242510	0.1259	0.99994	47	106.6
787	0.57652	242806	0.1262	0.99992	47	108.5
788	0.57724	241834	0.1265	0.99994	47	109.2
789	0.57723	241849	0.1268	0.99994	47	109.3
790	0.57677	242467	0.1270	0.99991	48	109.7
791	0.57715	241959	0.1274	0.99990	47	113.9
792	0.57751	241468	0.1275	0.99993	47	105.4
793	0.57717	241931	0.1277	0.99993	47	108.0
794	0.57790	240942	0.1280	0.99992	48	109.4
795	0.57741	241597	0.1282	0.99993	47	108.2
796	0.57776	241132	0.1285	0.99993	48	114.4
797	0.57781	241067	0.1288	0.99993	47	113.9
798	0.57799	240823	0.1291	0.99993	48	114.6
799	0.57798	240831	0.1293	0.99989	49	113.6
800	0.57821	240520	0.1295	0.99993	47	107.3
801	0.57867	239894	0.1299	0.99992	49	115.3
802	0.57857	240030	0.1301	0.99992	48	113.5
803	0.57858	240022	0.1303	0.99994	47	107.5
804	0.57819	240541	0.1305	0.99993	47	113.0
805	0.57882	239691	0.1308	0.99993	48	114.1
806	0.57892	239560	0.1309	0.99993	48	107.1
807	0.57868	239879	0.1312	0.99992	47	113.6
808	0.57876	239778	0.1315	0.99993	48	115.1
809	0.57924	239131	0.1317	0.99991	48	109.2
810	0.57924	239134	0.1319	0.99993	48	112.9
811	0.57945	238851	0.1320	0.99994	46	108.7
812	0.57978	238403	0.1322	0.99993	48	112.5
813	0.57971	238500	0.1324	0.99992	48	112.8
814	0.57998	238133	0.1327	0.99992	49	115.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
815	0.57989	238254	0.1330	0.99992	48	114.7
816	0.57971	238492	0.1333	0.99991	48	115.7
817	0.57984	238322	0.1335	0.99991	48	108.2
818	0.58016	237900	0.1337	0.99993	47	109.0
819	0.58008	237997	0.1340	0.99993	48	116.0
820	0.58055	237373	0.1343	0.99993	49	114.6
821	0.58021	237831	0.1345	0.99994	47	108.6
822	0.58017	237881	0.1348	0.99993	47	114.8
823	0.58053	237400	0.1350	0.99991	49	114.3
824	0.58044	237512	0.1353	0.99993	47	109.7
825	0.58116	236556	0.1356	0.99992	48	115.4
826	0.58098	236792	0.1358	0.99992	49	115.0
827	0.58137	236268	0.1361	0.99993	48	114.6
828	0.58111	236622	0.1365	0.99993	48	116.6
829	0.58120	236502	0.1368	0.99992	49	116.8
830	0.58164	235909	0.1370	0.99993	48	114.4
831	0.58151	236089	0.1373	0.99994	48	116.9
832	0.58176	235755	0.1375	0.99993	48	113.6
833	0.58178	235730	0.1377	0.99994	48	114.9
834	0.58183	235666	0.1380	0.99992	49	115.9
835	0.58184	235639	0.1383	0.99992	49	116.6
836	0.58193	235522	0.1386	0.99992	48	115.5
837	0.58222	235138	0.1389	0.99993	49	116.0
838	0.58218	235187	0.1392	0.99992	49	115.9
839	0.58230	235027	0.1394	0.99992	48	115.5
840	0.58250	234766	0.1396	0.99993	48	114.1
841	0.58260	234627	0.1399	0.99993	48	115.7
842	0.58254	234707	0.1401	0.99992	48	115.1
843	0.58294	234182	0.1405	0.99992	49	117.2
844	0.58256	234683	0.1408	0.99993	49	114.9
845	0.58270	234498	0.1409	0.99992	48	114.6
846	0.58305	234039	0.1412	0.99992	48	115.2
847	0.58305	234030	0.1415	0.99993	48	117.3
848	0.58327	233738	0.1417	0.99992	48	114.7
849	0.58315	233901	0.1419	0.99993	48	115.5
850	0.58341	233553	0.1422	0.99993	48	116.0
851	0.58356	233360	0.1425	0.99991	49	116.5
852	0.58338	233594	0.1428	0.99993	48	118.2
853	0.58370	233174	0.1431	0.99992	48	116.1
854	0.58369	233189	0.1433	0.99994	48	117.5
855	0.58407	232680	0.1435	0.99994	48	111.6
856	0.58410	232646	0.1437	0.99993	48	115.0
857	0.58409	232659	0.1440	0.99993	48	116.7
858	0.58410	232651	0.1443	0.99993	48	117.5
859	0.58449	232131	0.1445	0.99991	48	116.1
860	0.58479	231734	0.1448	0.99992	49	117.1
861	0.58451	232101	0.1452	0.99988	49	117.7
862	0.58478	231746	0.1454	0.99991	48	116.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
863	0.58463	231948	0.1456	0.99991	47	111.3
864	0.58514	231270	0.1459	0.99992	48	116.8
865	0.58506	231382	0.1461	0.99991	48	116.4
866	0.58479	231729	0.1464	0.99991	48	117.5
867	0.58530	231058	0.1467	0.99991	49	117.0
868	0.58545	230858	0.1470	0.99991	48	116.2
869	0.58544	230874	0.1473	0.99991	48	118.6
870	0.58597	230181	0.1476	0.99992	49	117.4
871	0.58580	230399	0.1480	0.99992	48	118.6
872	0.58611	229998	0.1482	0.99993	48	118.4
873	0.58635	229678	0.1485	0.99992	49	117.7
874	0.58625	229820	0.1488	0.99990	49	116.5
875	0.58668	229256	0.1492	0.99992	49	119.2
876	0.58695	228899	0.1496	0.99991	48	118.2
877	0.58705	228763	0.1498	0.99991	49	117.4
878	0.58735	228375	0.1502	0.99993	48	117.1
879	0.58718	228593	0.1505	0.99992	48	118.4
880	0.58770	227913	0.1508	0.99991	48	114.0
881	0.58754	228130	0.1513	0.99991	49	116.4
882	0.58790	227656	0.1516	0.99992	48	113.8
883	0.58827	227171	0.1521	0.99991	49	117.9
884	0.58848	226898	0.1526	0.99991	49	117.8
885	0.58853	226837	0.1531	0.99992	49	116.8
886	0.58894	226304	0.1536	0.99992	49	117.5
887	0.58903	226187	0.1541	0.99990	49	121.4
888	0.58954	225526	0.1545	0.99992	48	116.6
889	0.58973	225281	0.1550	0.99992	49	118.5
890	0.58975	225252	0.1555	0.99991	49	123.6
891	0.59026	224593	0.1560	0.99991	49	116.9
892	0.59026	224591	0.1566	0.99989	49	119.5
893	0.59073	223987	0.1571	0.99992	49	117.9
894	0.59118	223405	0.1577	0.99989	49	121.6
895	0.59077	223936	0.1581	0.99990	49	117.6
896	0.59104	223586	0.1587	0.99991	49	119.7
897	0.59126	223301	0.1592	0.99992	48	121.7
898	0.59189	222493	0.1597	0.99990	49	119.6
899	0.59190	222477	0.1603	0.99992	49	118.5
900	0.59224	222042	0.1608	0.99991	49	123.1
901	0.59266	221506	0.1613	0.99991	49	121.1
902	0.59278	221362	0.1619	0.99991	49	118.8
903	0.59351	220428	0.1623	0.99991	50	123.4
904	0.59342	220536	0.1628	0.99992	48	117.8
905	0.59352	220407	0.1633	0.99991	49	119.0
906	0.59429	219423	0.1638	0.99991	50	120.6
907	0.59410	219666	0.1642	0.99991	48	123.4
908	0.59437	219325	0.1648	0.99991	49	125.1
909	0.59426	219463	0.1654	0.99988	50	122.7
910	0.59493	218614	0.1661	0.99990	50	122.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
911	0.59503	218485	0.1667	0.99991	48	124.9
912	0.59547	217934	0.1672	0.99991	49	125.8
913	0.59569	217657	0.1677	0.99990	50	124.3
914	0.59523	218230	0.1683	0.99989	49	121.7
915	0.59587	217426	0.1688	0.99992	49	120.0
916	0.59616	217056	0.1694	0.99990	50	126.4
917	0.59619	217019	0.1699	0.99993	49	120.6
918	0.59638	216784	0.1704	0.99992	49	125.6
919	0.59698	216021	0.1710	0.99991	50	126.6
920	0.59719	215764	0.1715	0.99990	48	125.5
921	0.59743	215459	0.1720	0.99992	49	126.7
922	0.59744	215451	0.1725	0.99991	49	126.9
923	0.59762	215219	0.1732	0.99989	51	124.7
924	0.59776	215041	0.1740	0.99988	50	124.1
925	0.59834	214320	0.1748	0.99990	50	124.9
926	0.59852	214093	0.1755	0.99990	50	129.2
927	0.59909	213375	0.1762	0.99991	49	128.7
928	0.59964	212693	0.1770	0.99991	50	126.0
929	0.59995	212310	0.1778	0.99991	50	126.1
930	0.60055	211555	0.1784	0.99992	49	124.8
931	0.60110	210876	0.1792	0.99990	50	127.9
932	0.60133	210598	0.1801	0.99988	51	129.4
933	0.60183	209978	0.1808	0.99988	50	125.6
934	0.60196	209811	0.1815	0.99989	49	125.1
935	0.60215	209575	0.1823	0.99986	50	128.4
936	0.60251	209137	0.1830	0.99988	50	126.6
937	0.60244	209216	0.1837	0.99989	50	130.3
938	0.60324	208238	0.1846	0.99989	50	128.1
939	0.60364	207743	0.1853	0.99990	50	126.2
940	0.60407	207217	0.1862	0.99990	51	130.1
941	0.60449	206699	0.1872	0.99988	51	131.5
942	0.60486	206254	0.1881	0.99988	51	131.8
943	0.60522	205810	0.1891	0.99986	51	130.5
944	0.60588	205012	0.1901	0.99989	50	132.9
945	0.60638	204397	0.1910	0.99988	51	129.9
946	0.60666	204059	0.1921	0.99987	51	134.3
947	0.60734	203238	0.1931	0.99988	51	130.9
948	0.60802	202418	0.1942	0.99987	51	131.1
949	0.60845	201900	0.1953	0.99984	51	135.3
950	0.60941	200747	0.1966	0.99989	50	135.4
951	0.60983	200236	0.1978	0.99981	52	133.5
952	0.61085	199015	0.1990	0.99987	51	131.3
953	0.61158	198149	0.2003	0.99986	51	131.5
954	0.61276	196747	0.2016	0.99988	51	133.8
955	0.61328	196126	0.2032	0.99985	51	134.5
956	0.61362	195730	0.2049	0.99981	51	133.3
957	0.61486	194265	0.2065	0.99982	52	139.7
958	0.61574	193240	0.2081	0.99984	51	139.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
959	0.61716	191575	0.2098	0.99984	51	140.9
960	0.61841	190124	0.2115	0.99982	51	138.1
961	0.61963	188715	0.2134	0.99976	52	139.6
962	0.62033	187911	0.2156	0.99981	51	138.8
963	0.62142	186653	0.2180	0.99977	52	138.5
964	0.62243	185494	0.2203	0.99979	52	144.3
965	0.62327	184543	0.2224	0.99982	52	143.1
966	0.62448	183167	0.2249	0.99984	51	141.0
967	0.62589	181576	0.2275	0.99982	52	148.8
968	0.62653	180861	0.2301	0.99983	52	148.1
969	0.62739	179896	0.2326	0.99983	52	149.2
970	0.62795	179261	0.2352	0.99985	52	148.3
971	0.62921	177856	0.2379	0.99985	51	152.0

Table C14 Crack Growth Rate Results - Specimen GPQ-20

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
79.5	49459	0.00020
76.3	48453	0.00012
79.0	49303	0.00009
76.8	48611	0.00008
81.7	50138	0.00007
80.7	49830	0.00007
87.0	51739	0.00008
86.4	51560	0.00007
82.0	50230	0.00007
87.1	51769	0.00009
85.3	51231	0.00009
86.4	51560	0.00005
88.1	52065	0.00007
87.4	51858	0.00007
87.8	51976	0.00006
86.6	51620	0.00007
95.3	54151	0.00007
92.6	53378	0.00007
93.4	53608	0.00005
95.7	54264	0.00006
94.1	53809	0.00006
98.9	55164	0.00008
93.9	53752	0.00005
101.8	55967	0.00005
96.5	54491	0.00006
103.3	56378	0.00008
97.0	54632	0.00008
103.2	56351	0.00008
104.1	56596	0.00009
105.1	56867	0.00008
105.1	56867	0.00008
107.8	57593	0.00011
108.2	57699	0.00006
107.3	57459	0.00008
108.2	57699	0.00011
115.4	59588	0.00009
111.6	58599	0.00011
118.2	60307	0.00011
117.4	60102	0.00020
116.9	59974	0.00016
123.4	61619	0.00024
126.4	62364	0.00025
128.7	62929	0.00023
128.4	62855	0.00038
130.5	63367	0.00035

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
131.1	63513	0.00046
131.5	63609	0.00061
139.7	65563	0.00076
140.9	65844	0.00099
138.8	65351	0.00134
143.1	66356	0.00098
148.1	67505	0.00110
152.0	68388	0.00084

Table C15 Tabulated Results for Cyclic J Specimen GPQ-9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.49254	377337	0.0137	0.99931	35	110.6
2	0.49166	378984	0.0148	0.99936	38	111.8
3	0.49188	378558	0.0152	0.99948	38	110.6
4	0.49217	378015	0.0155	0.99956	39	111.8
5	0.49192	378487	0.0157	0.99968	38	111.2
6	0.49219	377988	0.0159	0.99964	39	113.7
7	0.49241	377570	0.0161	0.99967	39	111.1
8	0.49288	376700	0.0163	0.99971	39	114.4
9	0.49308	376312	0.0164	0.99973	39	114.2
10	0.49298	376500	0.0166	0.99961	39	114.6
11	0.49326	375993	0.0168	0.99967	40	115.7
12	0.49358	375391	0.0169	0.99966	40	114.6
13	0.49392	374758	0.0170	0.99979	40	111.9
14	0.49391	374766	0.0172	0.99975	40	113.8
15	0.49299	376494	0.0173	0.99924	41	113.1
16	0.49418	374264	0.0177	0.99975	40	114.3
17	0.49449	373693	0.0177	0.99979	40	111.7
18	0.49474	373226	0.0178	0.99978	41	113.2
19	0.49478	373156	0.0180	0.99977	41	114.0
20	0.49490	372925	0.0180	0.99977	42	115.1
21	0.49478	373159	0.0182	0.99977	42	116.5
22	0.49475	373206	0.0183	0.99976	42	113.6
23	0.49562	371600	0.0183	0.99980	42	113.9
24	0.49536	372083	0.0184	0.99977	43	117.3
25	0.49552	371788	0.0185	0.99982	42	113.6
26	0.49530	372181	0.0186	0.99979	42	115.6
27	0.49571	371438	0.0187	0.99982	41	115.4
28	0.49599	370907	0.0187	0.99982	42	114.5
29	0.49615	370610	0.0188	0.99977	43	116.7
30	0.49605	370798	0.0189	0.99977	43	116.5
31	0.49631	370318	0.0190	0.99981	42	115.3
32	0.49664	369711	0.0191	0.99979	44	114.0
33	0.49644	370077	0.0191	0.99983	43	113.0
34	0.49656	369870	0.0192	0.99975	44	117.5
35	0.49726	368570	0.0192	0.99983	44	113.4
36	0.49689	369247	0.0193	0.99977	44	115.8
37	0.49714	368792	0.0193	0.99982	44	115.1
38	0.49725	368592	0.0194	0.99980	45	115.0
39	0.49636	370225	0.0194	0.99958	45	115.3
40	0.49697	369113	0.0197	0.99979	44	117.1
41	0.49737	368377	0.0197	0.99977	45	114.8
42	0.49772	367735	0.0199	0.99974	45	116.7
43	0.49776	367655	0.0200	0.99974	46	116.1
44	0.49775	367678	0.0200	0.99982	45	115.1
45	0.49795	367307	0.0201	0.99978	47	117.9
46	0.49779	367602	0.0201	0.99979	46	117.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
47	0.49814	366952	0.0202	0.99980	48	115.8
48	0.49789	367412	0.0203	0.99974	48	118.9
49	0.49815	366938	0.0204	0.99980	49	116.5
50	0.49836	366556	0.0204	0.99977	49	118.5
51	0.49825	366759	0.0206	0.99975	49	118.5
52	0.49841	366463	0.0206	0.99976	50	117.5
53	0.49857	366165	0.0207	0.99978	49	118.3
54	0.49889	365586	0.0207	0.99981	50	115.9
55	0.49865	366020	0.0208	0.99980	50	117.2
56	0.49933	364780	0.0209	0.99981	51	117.6
57	0.49939	364669	0.0210	0.99981	52	116.6
58	0.49938	364697	0.0211	0.99976	52	119.0
59	0.49921	364995	0.0212	0.99979	52	117.7
60	0.49950	364469	0.0213	0.99977	53	119.6
61	0.50007	363426	0.0214	0.99977	53	120.8
62	0.50053	362590	0.0214	0.99981	54	118.4
63	0.49950	364468	0.0215	0.99974	54	117.6
64	0.50028	363055	0.0216	0.99980	54	116.4
65	0.50006	363453	0.0217	0.99976	55	118.8
66	0.50014	363298	0.0218	0.99976	55	117.8
67	0.50047	362715	0.0219	0.99978	55	116.8
68	0.50071	362269	0.0220	0.99976	56	120.5
69	0.50168	360507	0.0221	0.99981	56	117.0
70	0.50043	362785	0.0222	0.99955	57	119.7
71	0.50147	360903	0.0223	0.99971	57	117.6
72	0.50182	360253	0.0224	0.99977	57	118.7
73	0.50250	359033	0.0224	0.99981	58	118.3
74	0.50265	358759	0.0227	0.99979	58	121.9
75	0.50287	358365	0.0227	0.99979	58	121.5
76	0.50320	357773	0.0228	0.99980	59	120.9
77	0.50349	357257	0.0230	0.99974	59	121.0
78	0.50376	356776	0.0230	0.99981	59	120.0
79	0.50398	356369	0.0231	0.99981	59	120.5
80	0.50357	357106	0.0232	0.99972	60	121.5
81	0.50417	356041	0.0233	0.99978	59	120.5
82	0.50443	355576	0.0235	0.99973	60	124.3
83	0.50420	355991	0.0236	0.99975	60	119.7
84	0.50476	354980	0.0237	0.99974	60	121.8
85	0.50482	354874	0.0238	0.99978	60	119.5
86	0.50511	354361	0.0239	0.99973	61	121.9
87	0.50543	353783	0.0240	0.99977	61	122.1
88	0.50591	352929	0.0241	0.99980	61	121.8
89	0.50551	353636	0.0242	0.99973	62	124.0
90	0.50553	353615	0.0244	0.99967	61	125.4
91	0.50618	352448	0.0244	0.99976	61	121.6
92	0.50618	352444	0.0245	0.99972	62	124.5
93	0.50591	352935	0.0247	0.99962	62	121.4
94	0.50662	351674	0.0249	0.99970	62	124.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
95	0.50697	351052	0.0249	0.99975	62	123.8
96	0.50651	351868	0.0251	0.99964	62	123.2
97	0.50685	351262	0.0252	0.99971	62	122.4
98	0.50692	351147	0.0253	0.99970	63	124.7
99	0.50719	350658	0.0254	0.99975	63	122.4
100	0.50723	350598	0.0255	0.99969	63	124.3
101	0.50784	349509	0.0256	0.99974	63	124.2
102	0.50710	350814	0.0257	0.99966	63	126.9
103	0.50728	350508	0.0259	0.99966	63	123.3
104	0.50787	349468	0.0259	0.99970	63	122.4
105	0.50744	350221	0.0261	0.99970	63	125.2
106	0.50803	349172	0.0262	0.99967	63	125.7
107	0.50803	349170	0.0263	0.99973	63	125.4
108	0.50816	348951	0.0264	0.99975	63	124.9
109	0.50853	348303	0.0265	0.99969	63	125.9
110	0.50869	348021	0.0266	0.99974	64	123.2
111	0.50895	347565	0.0267	0.99971	64	124.1
112	0.50876	347898	0.0268	0.99968	64	123.7
113	0.50902	347442	0.0269	0.99974	63	125.0
114	0.50908	347333	0.0270	0.99973	64	127.0
115	0.50833	348652	0.0272	0.99958	64	126.3
116	0.50959	346436	0.0273	0.99978	63	123.3
117	0.50920	347118	0.0275	0.99971	64	126.5
118	0.50961	346391	0.0275	0.99974	64	126.7
119	0.50980	346060	0.0277	0.99974	64	127.1
120	0.50930	346940	0.0279	0.99956	64	124.8
121	0.50989	345902	0.0280	0.99967	64	126.5
122	0.50998	345743	0.0281	0.99966	65	125.0
123	0.50962	346376	0.0283	0.99960	65	128.5
124	0.51042	344977	0.0285	0.99966	64	125.4
125	0.51040	345024	0.0286	0.99966	65	128.5
126	0.51082	344291	0.0287	0.99974	65	123.2
127	0.51078	344354	0.0289	0.99962	65	128.3
128	0.51097	344023	0.0290	0.99971	64	124.2
129	0.51128	343472	0.0292	0.99965	65	128.0
130	0.51160	342922	0.0292	0.99975	65	123.8
131	0.51035	345105	0.0293	0.99922	65	125.9
132	0.51151	343087	0.0298	0.99964	65	127.8
133	0.51158	342963	0.0300	0.99960	65	130.3
134	0.51220	341873	0.0301	0.99974	65	126.9
135	0.51266	341090	0.0302	0.99969	66	127.6
136	0.51254	341283	0.0303	0.99976	65	125.0
137	0.51217	341938	0.0305	0.99959	65	129.4
138	0.51290	340674	0.0306	0.99969	66	125.5
139	0.51289	340688	0.0308	0.99967	66	129.7
140	0.51321	340129	0.0309	0.99970	65	129.5
141	0.51305	340408	0.0311	0.99957	66	129.7
142	0.51294	340595	0.0313	0.99961	66	131.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
143	0.51374	339210	0.0314	0.99969	66	128.7
144	0.51343	339753	0.0316	0.99966	66	130.7
145	0.51360	339457	0.0318	0.99967	66	127.9
146	0.51404	338699	0.0320	0.99964	66	132.1
147	0.51436	338140	0.0321	0.99968	66	128.1
148	0.51389	338965	0.0323	0.99962	66	131.7
149	0.51460	337739	0.0323	0.99973	65	128.8
150	0.51460	337738	0.0325	0.99965	66	132.0
151	0.51538	336402	0.0326	0.99974	66	126.6
152	0.51543	336314	0.0328	0.99966	67	130.6
153	0.51536	336424	0.0329	0.99973	66	126.5
154	0.51571	335832	0.0330	0.99971	66	130.1
155	0.51528	336560	0.0332	0.99964	66	130.5
156	0.51569	335871	0.0334	0.99964	67	130.8
157	0.51570	335850	0.0335	0.99963	67	129.6
158	0.51595	335423	0.0336	0.99966	67	130.4
159	0.51616	335065	0.0338	0.99968	66	129.3
160	0.51661	334282	0.0340	0.99961	67	130.4
161	0.51655	334386	0.0342	0.99959	67	133.1
162	0.51650	334470	0.0344	0.99958	67	132.8
163	0.51668	334170	0.0345	0.99959	67	131.8
164	0.51708	333487	0.0347	0.99960	67	133.8
165	0.51733	333064	0.0349	0.99961	67	132.7
166	0.51723	333230	0.0351	0.99960	67	130.6
167	0.51798	331958	0.0353	0.99967	67	132.2
168	0.51717	333332	0.0355	0.99933	67	133.5
169	0.51825	331498	0.0357	0.99965	67	131.8
170	0.51828	331454	0.0359	0.99963	67	131.0
171	0.51808	331782	0.0362	0.99946	67	132.3
172	0.51847	331131	0.0364	0.99951	67	131.9
173	0.51889	330411	0.0366	0.99953	67	132.2
174	0.51915	329973	0.0367	0.99967	67	131.2
175	0.51943	329502	0.0369	0.99965	67	130.8
176	0.51943	329509	0.0372	0.99956	67	131.5
177	0.51932	329696	0.0373	0.99961	67	130.5
178	0.52004	328477	0.0375	0.99959	68	135.3
179	0.51975	328959	0.0377	0.99956	67	134.2
180	0.52020	328204	0.0379	0.99957	67	135.2
181	0.52042	327842	0.0381	0.99957	67	135.5
182	0.52096	326934	0.0383	0.99961	67	131.9
183	0.52045	327788	0.0386	0.99943	68	135.8
184	0.52106	326765	0.0388	0.99958	68	134.6
185	0.52124	326451	0.0390	0.99964	68	134.3
186	0.52144	326116	0.0392	0.99962	67	133.9
187	0.52139	326199	0.0394	0.99955	67	134.1
188	0.52172	325660	0.0396	0.99956	67	134.4
189	0.52178	325550	0.0398	0.99959	67	133.3
190	0.52162	325818	0.0401	0.99925	68	137.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
191	0.52178	325559	0.0404	0.99931	68	135.7
192	0.52237	324566	0.0407	0.99931	68	137.2
193	0.52277	323894	0.0410	0.99956	67	133.9
194	0.52251	324340	0.0413	0.99936	67	135.4
195	0.52261	324173	0.0416	0.99931	67	135.6
196	0.52320	323189	0.0419	0.99934	68	139.1
197	0.52351	322665	0.0423	0.99933	68	136.1
198	0.52365	322430	0.0425	0.99937	68	136.3
199	0.52382	322153	0.0429	0.99940	68	138.8
200	0.52453	320980	0.0431	0.99959	68	137.4
201	0.52434	321288	0.0433	0.99950	68	137.4
202	0.52408	321721	0.0437	0.99935	68	139.0
203	0.52502	320158	0.0438	0.99959	68	137.4
204	0.52464	320785	0.0442	0.99935	68	138.8
205	0.52455	320947	0.0444	0.99928	68	138.1
206	0.52498	320229	0.0448	0.99939	68	136.8
207	0.52599	318568	0.0450	0.99958	68	137.5
208	0.52644	317829	0.0453	0.99956	68	137.8
209	0.52625	318127	0.0456	0.99938	68	139.0
210	0.52647	317765	0.0459	0.99936	68	139.3
211	0.52710	316733	0.0462	0.99939	69	142.9
212	0.52758	315955	0.0464	0.99957	69	137.7
213	0.52744	316178	0.0467	0.99938	69	141.9
214	0.52764	315860	0.0470	0.99943	68	142.0
215	0.52792	315398	0.0473	0.99933	68	140.0
216	0.52817	314981	0.0476	0.99942	68	142.0
217	0.52820	314946	0.0479	0.99949	68	140.4
218	0.52862	314246	0.0481	0.99952	68	140.7
219	0.52818	314974	0.0484	0.99931	68	143.0
220	0.52880	313962	0.0488	0.99934	69	142.6
221	0.52918	313341	0.0491	0.99935	69	142.5
222	0.52944	312922	0.0493	0.99952	69	140.8
223	0.52959	312674	0.0496	0.99951	69	140.9
224	0.52957	312704	0.0498	0.99944	68	141.1
225	0.52919	313324	0.0502	0.99928	68	142.2
226	0.52944	312911	0.0505	0.99929	68	142.5
227	0.52973	312454	0.0509	0.99932	68	143.0
228	0.52985	312256	0.0512	0.99938	68	141.5
229	0.53034	311457	0.0516	0.99928	67	144.1
230	0.53040	311367	0.0519	0.99943	68	141.6
231	0.53037	311412	0.0522	0.99934	68	141.6
232	0.53109	310244	0.0525	0.99936	69	145.7
233	0.53098	310420	0.0528	0.99932	69	146.7
234	0.53157	309462	0.0532	0.99937	69	142.2
235	0.53159	309437	0.0535	0.99939	69	145.5
236	0.53183	309056	0.0539	0.99931	69	145.8
237	0.53186	309000	0.0542	0.99928	69	143.7
238	0.53212	308590	0.0546	0.99929	69	146.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
239	0.53248	308001	0.0549	0.99935	69	146.8
240	0.53275	307572	0.0553	0.99935	69	146.2
241	0.53291	307312	0.0556	0.99938	68	143.5
242	0.53350	306362	0.0559	0.99950	69	143.7
243	0.53346	306439	0.0562	0.99939	69	145.0
244	0.53396	305632	0.0564	0.99954	69	143.4
245	0.53374	305989	0.0568	0.99928	69	146.9
246	0.53405	305496	0.0571	0.99941	69	145.4
247	0.53442	304906	0.0574	0.99940	69	145.4
248	0.53435	305009	0.0578	0.99926	69	146.0
249	0.53462	304580	0.0582	0.99933	69	145.4
250	0.53494	304077	0.0585	0.99934	69	145.6
251	0.53498	304007	0.0588	0.99933	69	145.7
252	0.53534	303437	0.0591	0.99944	69	145.3
253	0.53560	303027	0.0594	0.99940	69	145.4
254	0.53560	303021	0.0598	0.99937	69	145.4
255	0.53607	302268	0.0601	0.99942	69	145.2
256	0.53626	301968	0.0604	0.99935	69	148.8
257	0.53655	301523	0.0607	0.99940	69	150.4
258	0.53702	300771	0.0611	0.99937	69	150.0
259	0.53656	301493	0.0615	0.99906	69	148.8
260	0.53718	300523	0.0619	0.99928	69	150.8
261	0.53701	300792	0.0624	0.99907	69	151.4
262	0.53736	300229	0.0629	0.99906	69	151.8
263	0.53806	299136	0.0633	0.99927	69	151.2
264	0.53872	298093	0.0636	0.99941	69	148.7
265	0.53830	298761	0.0641	0.99914	69	152.0
266	0.53887	297859	0.0645	0.99924	69	152.1
267	0.53895	297741	0.0650	0.99922	69	151.3
268	0.53913	297458	0.0654	0.99912	69	152.2
269	0.53946	296939	0.0659	0.99910	69	152.1
270	0.54007	295979	0.0664	0.99913	69	152.5
271	0.54017	295830	0.0668	0.99918	69	151.6
272	0.54070	295001	0.0674	0.99914	69	153.4
273	0.54123	294178	0.0679	0.99918	69	156.6
274	0.54145	293841	0.0683	0.99930	69	154.9
275	0.54162	293575	0.0687	0.99914	69	152.4
276	0.54197	293029	0.0692	0.99912	69	157.0
277	0.54256	292108	0.0697	0.99917	69	152.6
278	0.54288	291621	0.0701	0.99917	69	155.8
279	0.54330	290965	0.0706	0.99904	69	157.7
280	0.54365	290434	0.0711	0.99920	69	153.1
281	0.54363	290456	0.0716	0.99891	69	155.2
282	0.54368	290379	0.0722	0.99890	69	158.9
283	0.54421	289569	0.0727	0.99926	69	155.5
284	0.54440	289273	0.0732	0.99913	69	157.1
285	0.54475	288743	0.0737	0.99917	69	155.5
286	0.54481	288651	0.0741	0.99909	69	156.4

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
287	0.54536	287801	0.0746	0.99920	69	156.0
288	0.54568	287317	0.0752	0.99902	69	159.8
289	0.54580	287128	0.0758	0.99898	69	159.1
290	0.54624	286464	0.0763	0.99897	69	156.8
291	0.54653	286013	0.0769	0.99884	69	158.4
292	0.54686	285511	0.0776	0.99893	69	159.5
293	0.54732	284824	0.0782	0.99897	69	158.1
294	0.54742	284659	0.0788	0.99886	69	159.3
295	0.54870	282733	0.0793	0.99916	70	158.2
296	0.54854	282962	0.0799	0.99895	70	162.7
297	0.54845	283098	0.0805	0.99893	69	163.3
298	0.54890	282426	0.0811	0.99894	69	162.7
299	0.54951	281497	0.0817	0.99898	69	162.4
300	0.54989	280925	0.0824	0.99895	69	163.7
301	0.55031	280305	0.0830	0.99901	69	162.6
302	0.55047	280067	0.0836	0.99890	69	163.9
303	0.55136	278725	0.0841	0.99919	70	161.3
304	0.55118	279000	0.0847	0.99897	69	163.0
305	0.55156	278424	0.0854	0.99899	70	162.8
306	0.55201	277751	0.0860	0.99896	70	163.5
307	0.55227	277370	0.0867	0.99892	70	165.1
308	0.55266	276786	0.0873	0.99890	70	166.3
309	0.55289	276444	0.0880	0.99893	70	165.3
310	0.55310	276125	0.0886	0.99876	70	165.1
311	0.55338	275717	0.0894	0.99857	70	166.4
312	0.55392	274912	0.0902	0.99891	70	168.7
313	0.55426	274417	0.0908	0.99904	70	166.7
314	0.55464	273848	0.0914	0.99904	70	167.7
315	0.55483	273568	0.0921	0.99897	70	167.1
316	0.55511	273159	0.0927	0.99906	70	167.0
317	0.55581	272123	0.0933	0.99904	70	168.9
318	0.55613	271656	0.0938	0.99912	70	166.7
319	0.55670	270822	0.0944	0.99909	70	169.9
320	0.55687	270570	0.0950	0.99902	70	169.2
321	0.55712	270194	0.0957	0.99890	70	168.9
322	0.55756	269561	0.0964	0.99873	70	170.2
323	0.55787	269109	0.0973	0.99884	70	174.0
324	0.55814	268704	0.0980	0.99879	70	174.8
325	0.55916	267223	0.0987	0.99893	70	175.5
326	0.55908	267337	0.0995	0.99891	70	174.1
327	0.55968	266466	0.1002	0.99884	70	175.1
328	0.55982	266261	0.1008	0.99893	70	173.9
329	0.56031	265553	0.1016	0.99885	70	174.3
330	0.56053	265235	0.1023	0.99884	70	175.2
331	0.56148	263864	0.1031	0.99892	71	175.7
332	0.56181	263394	0.1037	0.99903	71	176.9
333	0.56177	263451	0.1043	0.99903	70	176.3
334	0.56222	262812	0.1049	0.99905	70	176.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
335	0.56278	261995	0.1056	0.99911	71	176.3
336	0.56290	261836	0.1062	0.99903	71	177.7
337	0.56334	261207	0.1068	0.99906	70	175.2
338	0.56330	261259	0.1075	0.99880	70	179.1
339	0.56383	260506	0.1082	0.99911	71	176.9
340	0.56402	260223	0.1089	0.99896	71	178.5
341	0.56450	259539	0.1095	0.99909	71	176.9
342	0.56464	259350	0.1101	0.99903	71	176.7
343	0.56501	258817	0.1109	0.99883	70	181.0
344	0.56529	258427	0.1116	0.99892	70	179.1
345	0.56621	257117	0.1124	0.99898	70	180.6
346	0.56721	255710	0.1131	0.99903	71	180.2
347	0.56759	255172	0.1138	0.99895	71	180.4
348	0.56800	254597	0.1147	0.99877	70	182.2
349	0.56859	253768	0.1156	0.99878	71	183.7
350	0.56877	253519	0.1165	0.99882	71	182.5
351	0.56903	253153	0.1174	0.99881	71	186.8
352	0.56898	253213	0.1183	0.99872	70	187.4
353	0.56976	252135	0.1192	0.99882	70	186.8
354	0.57021	251502	0.1201	0.99880	70	186.3
355	0.57076	250735	0.1210	0.99886	70	189.8
356	0.57115	250194	0.1218	0.99877	71	187.6
357	0.57145	249777	0.1230	0.99866	70	189.7
358	0.57195	249083	0.1240	0.99872	70	189.2
359	0.57274	247989	0.1250	0.99874	70	189.0
360	0.57351	246931	0.1261	0.99868	70	190.1
361	0.57373	246629	0.1271	0.99874	70	189.9

Table C16 Crack Growth Rate Results - Specimen GPQ-9

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
118.5	60383	0.00008
117.0	60000	0.00013
120.5	60891	0.00023
122.4	61369	0.00021
125.4	62117	0.00014
129.5	63124	0.00015
129.3	63075	0.00017
131.2	63537	0.00017
137.2	64973	0.00019
137.4	65021	0.00020
142.0	66100	0.00026
145.7	66956	0.00020
145.4	66887	0.00021
150.0	67937	0.00022
152.5	68500	0.00024
157.7	69659	0.00033
156.8	69459	0.00031
162.4	70689	0.00033
163.5	70928	0.00036
167.0	71683	0.00033
174.8	73338	0.00036
175.7	73527	0.00037
178.5	74110	0.00036
180.2	74462	0.00033
186.3	75712	0.00050
190.1	76480	0.00043

Table C17 Tabulated Results for Cyclic J Specimen GPQ11

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.49225	377865	0.0165	0.99866	17	114.0
2	0.49179	378738	0.0174	0.99759	20	114.8
3	0.49263	377162	0.0187	0.99821	20	112.6
4	0.49408	374452	0.0192	0.99907	20	114.6
5	0.49456	373566	0.0198	0.99864	21	117.1
6	0.49420	374226	0.0203	0.99880	21	118.3
7	0.49490	372931	0.0207	0.99925	21	116.5
8	0.49571	371433	0.0211	0.99934	21	116.5
9	0.49653	369923	0.0213	0.99952	21	116.8
10	0.49795	367296	0.0215	0.99953	22	117.0
11	0.49676	369489	0.0218	0.99945	22	117.5
12	0.49693	369182	0.0221	0.99919	22	119.1
13	0.49679	369436	0.0224	0.99923	22	118.4
14	0.49786	367479	0.0226	0.99952	22	114.0
15	0.49728	368545	0.0229	0.99942	22	119.2
16	0.49818	366876	0.0230	0.99964	22	117.0
17	0.49793	367336	0.0233	0.99931	22	118.6
18	0.49767	367813	0.0237	0.99896	23	122.6
19	0.49877	365813	0.0240	0.99932	23	120.9
20	0.49893	365514	0.0243	0.99936	23	121.1
21	0.50042	362791	0.0244	0.99969	23	119.2
22	0.49980	363919	0.0245	0.99964	23	115.8
23	0.50000	363562	0.0247	0.99949	24	116.9
24	0.50055	362560	0.0248	0.99964	24	116.7
25	0.50011	363366	0.0250	0.99962	24	117.9
26	0.50003	363506	0.0253	0.99921	25	120.8
27	0.50016	363274	0.0254	0.99950	24	118.6
28	0.50096	361823	0.0256	0.99956	25	118.8
29	0.50010	363381	0.0259	0.99907	25	124.7
30	0.50163	360608	0.0261	0.99949	25	121.8
31	0.50112	361533	0.0262	0.99963	25	117.5
32	0.50094	361852	0.0264	0.99934	25	123.4
33	0.50015	363289	0.0267	0.99918	25	123.9
34	0.50218	359610	0.0268	0.99965	25	117.1
35	0.50341	357391	0.0269	0.99970	25	121.3
36	0.50299	358147	0.0270	0.99963	25	121.9
37	0.50403	356295	0.0272	0.99966	25	123.8
38	0.50343	357360	0.0273	0.99967	24	122.7
39	0.50424	355913	0.0275	0.99942	25	123.2
40	0.50328	357625	0.0278	0.99938	25	124.4
41	0.50374	356803	0.0279	0.99962	25	121.3
42	0.50440	355633	0.0280	0.99961	26	123.5
43	0.50468	355122	0.0281	0.99969	25	121.1
44	0.50443	355577	0.0284	0.99933	26	126.1
45	0.50401	356328	0.0285	0.99945	26	124.3
46	0.50492	354688	0.0286	0.99963	26	122.4

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
47	0.50554	353582	0.0288	0.99962	27	125.4
48	0.50439	355638	0.0290	0.99937	27	122.6
49	0.50595	352853	0.0291	0.99963	27	120.6
50	0.50510	354367	0.0293	0.99965	27	119.9
51	0.50479	354932	0.0296	0.99921	27	126.7
52	0.50542	353802	0.0298	0.99950	27	123.4
53	0.50662	351671	0.0300	0.99941	28	126.4
54	0.50668	351572	0.0302	0.99947	27	124.4
55	0.50722	350601	0.0303	0.99949	28	123.8
56	0.50701	350987	0.0304	0.99963	27	122.7
57	0.50635	352144	0.0305	0.99958	28	124.0
58	0.50660	351712	0.0308	0.99933	29	126.6
59	0.50733	350410	0.0310	0.99958	29	126.4
60	0.50647	351931	0.0312	0.99958	29	122.5
61	0.50789	349428	0.0313	0.99967	29	121.4
62	0.50789	349429	0.0314	0.99969	30	125.2
63	0.50679	351370	0.0316	0.99939	30	125.3
64	0.50783	349537	0.0318	0.99958	30	124.8
65	0.50776	349660	0.0321	0.99935	31	129.4
66	0.50869	348020	0.0322	0.99958	31	127.4
67	0.50838	348565	0.0325	0.99924	31	130.2
68	0.50886	347722	0.0327	0.99962	31	126.4
69	0.50942	346734	0.0328	0.99971	31	124.5
70	0.50957	346472	0.0329	0.99967	32	127.0
71	0.50903	347417	0.0332	0.99940	32	129.6
72	0.50962	346381	0.0333	0.99962	32	127.2
73	0.50888	347677	0.0336	0.99931	32	127.9
74	0.51060	344658	0.0337	0.99963	33	125.9
75	0.50990	345887	0.0340	0.99933	33	130.6
76	0.51074	344419	0.0342	0.99955	33	129.1
77	0.51111	343771	0.0345	0.99933	34	130.8
78	0.51198	342261	0.0346	0.99963	34	128.5
79	0.51137	343321	0.0349	0.99935	34	128.2
80	0.51223	341822	0.0351	0.99962	34	127.1
81	0.51151	343088	0.0353	0.99917	35	130.8
82	0.51251	341344	0.0356	0.99952	35	130.7
83	0.51265	341097	0.0357	0.99963	34	125.4
84	0.51183	342518	0.0361	0.99925	35	131.6
85	0.51154	343022	0.0364	0.99903	35	132.7
86	0.51292	340627	0.0367	0.99947	35	129.6
87	0.51384	339035	0.0368	0.99971	35	126.5
88	0.51362	339417	0.0370	0.99948	35	128.2
89	0.51496	337117	0.0372	0.99970	36	131.0
90	0.51433	338203	0.0375	0.99939	36	133.3
91	0.51489	337231	0.0377	0.99957	36	132.1
92	0.51425	338331	0.0380	0.99910	37	134.5
93	0.51543	336301	0.0382	0.99952	37	130.7
94	0.51554	336125	0.0383	0.99951	37	127.1

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
95	0.51578	335708	0.0386	0.99952	37	132.6
96	0.51599	335354	0.0389	0.99940	37	135.0
97	0.51630	334819	0.0392	0.99926	37	135.5
98	0.51792	332064	0.0394	0.99961	38	134.9
99	0.51756	332679	0.0396	0.99948	38	134.3
100	0.51887	330456	0.0398	0.99968	38	133.2
101	0.51840	331240	0.0401	0.99935	39	134.0
102	0.51866	330797	0.0404	0.99932	39	137.8
103	0.51953	329342	0.0406	0.99959	39	136.1
104	0.51890	330393	0.0409	0.99931	39	137.5
105	0.52013	328322	0.0410	0.99960	39	135.8
106	0.51904	330169	0.0413	0.99939	39	134.5
107	0.51960	329221	0.0416	0.99936	39	137.3
108	0.52046	327764	0.0417	0.99959	39	135.2
109	0.52011	328359	0.0420	0.99948	39	135.0
110	0.52056	327594	0.0421	0.99959	39	132.3
111	0.52016	328272	0.0424	0.99923	40	138.4
112	0.51972	329006	0.0428	0.99918	39	138.6
113	0.52020	328205	0.0430	0.99930	40	138.3
114	0.52024	328144	0.0432	0.99930	39	137.3
115	0.52052	327673	0.0435	0.99930	40	135.0
116	0.52092	326989	0.0437	0.99959	40	134.1
117	0.52100	326864	0.0439	0.99948	40	132.9
118	0.52076	327259	0.0443	0.99907	41	140.6
119	0.52063	327472	0.0447	0.99903	41	140.0
120	0.52091	327007	0.0450	0.99913	40	136.5
121	0.52048	327731	0.0454	0.99901	40	139.5
122	0.52169	325700	0.0458	0.99910	41	140.1
123	0.52114	326630	0.0461	0.99906	40	138.2
124	0.52179	325529	0.0465	0.99913	41	138.2
125	0.52292	323650	0.0467	0.99959	41	136.2
126	0.52230	324677	0.0470	0.99918	41	139.5
127	0.52210	325013	0.0474	0.99920	41	140.8
128	0.52296	323584	0.0476	0.99949	41	135.5
129	0.52263	324134	0.0479	0.99915	41	141.5
130	0.52270	324023	0.0483	0.99919	41	141.3
131	0.52310	323341	0.0486	0.99905	42	142.2
132	0.52378	322211	0.0490	0.99910	42	140.9
133	0.52328	323048	0.0493	0.99917	41	138.3
134	0.52378	322218	0.0497	0.99902	42	140.2
135	0.52478	320560	0.0499	0.99942	42	136.3
136	0.52394	321951	0.0503	0.99900	42	141.9
137	0.52464	320784	0.0506	0.99926	42	142.2
138	0.52596	318617	0.0508	0.99958	42	135.8
139	0.52483	320476	0.0512	0.99910	42	143.0
140	0.52482	320498	0.0515	0.99919	42	143.0
141	0.52622	318191	0.0516	0.99960	42	140.2
142	0.52665	317477	0.0518	0.99961	42	140.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
143	0.52495	320275	0.0521	0.99910	42	139.5
144	0.52568	319066	0.0525	0.99921	42	142.2
145	0.52672	317369	0.0527	0.99949	42	141.2
146	0.52606	318447	0.0531	0.99914	43	141.7
147	0.52676	317304	0.0534	0.99903	43	144.1
148	0.52620	318222	0.0538	0.99910	42	145.0
149	0.52703	316861	0.0540	0.99948	42	139.3
150	0.52805	315181	0.0542	0.99951	43	140.2
151	0.52793	315379	0.0545	0.99937	43	144.5
152	0.52805	315179	0.0547	0.99957	42	138.8
153	0.52794	315360	0.0550	0.99927	43	145.1
154	0.52761	315900	0.0553	0.99894	43	143.4
155	0.52782	315557	0.0557	0.99922	43	145.7
156	0.52839	314626	0.0559	0.99947	42	142.4
157	0.52794	315360	0.0563	0.99905	43	146.3
158	0.52807	315148	0.0566	0.99895	43	143.0
159	0.52907	313514	0.0570	0.99935	43	144.5
160	0.52840	314611	0.0574	0.99898	43	145.3
161	0.52855	314359	0.0578	0.99902	43	144.8
162	0.52859	314298	0.0582	0.99897	43	144.1
163	0.52957	312707	0.0585	0.99919	43	144.1
164	0.53052	311169	0.0588	0.99942	43	142.1
165	0.52890	313790	0.0592	0.99887	43	143.2
166	0.53026	311594	0.0596	0.99904	44	148.9
167	0.52981	312315	0.0599	0.99898	44	147.2
168	0.53024	311622	0.0603	0.99922	43	147.9
169	0.52971	312472	0.0607	0.99896	43	149.1
170	0.53070	310880	0.0611	0.99904	44	149.3
171	0.53095	310463	0.0615	0.99923	43	148.1
172	0.53180	309107	0.0617	0.99936	43	146.1
173	0.53177	309155	0.0620	0.99920	44	148.4
174	0.53172	309226	0.0624	0.99901	44	148.8
175	0.53192	308912	0.0627	0.99916	44	148.0
176	0.53258	307849	0.0631	0.99900	44	149.2
177	0.53268	307680	0.0634	0.99936	44	146.6
178	0.53233	308239	0.0637	0.99901	44	146.2
179	0.53278	307525	0.0641	0.99887	44	148.3
180	0.53353	306324	0.0644	0.99943	44	145.9
181	0.53362	306172	0.0648	0.99919	44	148.2
182	0.53364	306137	0.0651	0.99912	44	146.5
183	0.53289	307347	0.0655	0.99899	44	150.5
184	0.53366	306107	0.0658	0.99919	44	144.9
185	0.53400	305570	0.0662	0.99902	44	146.4
186	0.53348	306399	0.0667	0.99868	44	152.1
187	0.53404	305510	0.0671	0.99903	44	150.5
188	0.53439	304952	0.0675	0.99907	44	150.9
189	0.53495	304061	0.0678	0.99921	44	150.6
190	0.53519	303676	0.0682	0.99893	44	152.4

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
191	0.53521	303635	0.0686	0.99907	44	151.8
192	0.53537	303388	0.0690	0.99895	44	152.3
193	0.53572	302832	0.0693	0.99919	44	151.2
194	0.53538	303377	0.0698	0.99868	44	154.0
195	0.53686	301027	0.0702	0.99913	45	152.6
196	0.53719	300499	0.0706	0.99909	44	152.7
197	0.53748	300053	0.0710	0.99902	45	152.6
198	0.53735	300244	0.0713	0.99915	44	151.8
199	0.53679	301142	0.0718	0.99872	44	152.5
200	0.53813	299027	0.0722	0.99903	44	151.3
201	0.53745	300097	0.0727	0.99858	44	154.0
202	0.53823	298860	0.0731	0.99905	45	151.0
203	0.53877	298011	0.0735	0.99902	45	150.6
204	0.53909	297518	0.0738	0.99912	44	150.0
205	0.53785	299464	0.0743	0.99838	44	152.8
206	0.53868	298155	0.0748	0.99891	44	150.5
207	0.53943	296978	0.0751	0.99911	45	149.3
208	0.53866	298190	0.0756	0.99870	45	151.6
209	0.54063	295111	0.0759	0.99928	45	154.3
210	0.54010	295931	0.0763	0.99909	45	155.2
211	0.54023	295731	0.0767	0.99897	45	150.9
212	0.54075	294923	0.0772	0.99908	45	155.9
213	0.54079	294857	0.0775	0.99912	45	155.6
214	0.54054	295247	0.0779	0.99905	45	155.8
215	0.54097	294574	0.0783	0.99894	45	156.2
216	0.54057	295207	0.0788	0.99894	44	155.9
217	0.54174	293388	0.0792	0.99883	45	157.8
218	0.54184	293224	0.0796	0.99904	45	156.7
219	0.54210	292823	0.0800	0.99916	45	155.8
220	0.54258	292089	0.0804	0.99913	45	156.0
221	0.54258	292090	0.0808	0.99904	45	155.3
222	0.54257	292100	0.0813	0.99812	45	161.1
223	0.54312	291243	0.0820	0.99860	45	159.3
224	0.54354	290607	0.0824	0.99900	45	156.4
225	0.54359	290517	0.0828	0.99899	45	157.0
226	0.54366	290417	0.0834	0.99823	45	160.8
227	0.54350	290668	0.0841	0.99832	45	160.1
228	0.54431	289421	0.0847	0.99827	45	160.6
229	0.54438	289304	0.0854	0.99829	45	160.3
230	0.54517	288089	0.0859	0.99900	45	155.4
231	0.54495	288430	0.0865	0.99843	45	158.5
232	0.54642	286180	0.0869	0.99912	45	160.7
233	0.54579	287147	0.0873	0.99907	45	155.1
234	0.54552	287566	0.0879	0.99810	45	160.0
235	0.54524	287989	0.0886	0.99820	45	160.2
236	0.54596	286887	0.0893	0.99838	45	158.3
237	0.54758	284416	0.0898	0.99894	45	162.2
238	0.54679	285623	0.0904	0.99809	45	164.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
239	0.54773	284188	0.0911	0.99853	45	159.3
240	0.54805	283716	0.0916	0.99900	45	162.3
241	0.54787	283985	0.0922	0.99815	45	167.6
242	0.54825	283400	0.0929	0.99837	45	166.4
243	0.54852	282990	0.0936	0.99839	45	166.2
244	0.54877	282616	0.0942	0.99829	45	167.2
245	0.54899	282287	0.0949	0.99827	45	167.3
246	0.54933	281768	0.0956	0.99831	45	167.2
247	0.54978	281098	0.0963	0.99833	45	167.0
248	0.55042	280130	0.0969	0.99862	45	167.6
249	0.55015	280536	0.0976	0.99813	45	168.0
250	0.55125	278889	0.0983	0.99848	45	166.9
251	0.55127	278861	0.0989	0.99832	45	169.1
252	0.55094	279350	0.0997	0.99785	44	167.1
253	0.55156	278421	0.1005	0.99808	45	169.6
254	0.55315	276059	0.1012	0.99862	45	167.5
255	0.55309	276144	0.1019	0.99850	45	166.4
256	0.55288	276458	0.1025	0.99841	45	166.8
257	0.55446	274121	0.1032	0.99847	46	168.4
258	0.55350	275536	0.1038	0.99832	45	167.3
259	0.55511	273161	0.1044	0.99874	46	167.0
260	0.55538	272762	0.1050	0.99850	46	173.3
261	0.55459	273923	0.1058	0.99816	46	169.2
262	0.55498	273344	0.1064	0.99853	46	172.8
263	0.55567	272335	0.1070	0.99843	46	172.6
264	0.55620	271553	0.1077	0.99876	45	172.4
265	0.55516	273086	0.1085	0.99807	45	170.5
266	0.55560	272435	0.1093	0.99816	45	169.0
267	0.55665	270894	0.1101	0.99814	45	174.8
268	0.55679	270691	0.1110	0.99802	45	171.5
269	0.55777	269248	0.1116	0.99869	45	173.6
270	0.55733	269897	0.1125	0.99786	45	178.8
271	0.55885	267679	0.1131	0.99869	46	174.7
272	0.55814	268704	0.1138	0.99843	45	174.9
273	0.55871	267880	0.1145	0.99839	45	176.6
274	0.55866	267953	0.1151	0.99867	45	174.5
275	0.55932	267000	0.1159	0.99809	45	178.3
276	0.56006	265925	0.1166	0.99868	45	175.7
277	0.56007	265901	0.1172	0.99833	45	176.4
278	0.56089	264726	0.1179	0.99854	46	175.8
279	0.56106	264481	0.1186	0.99849	46	176.8
280	0.56051	265264	0.1193	0.99846	45	175.8
281	0.56177	263457	0.1199	0.99847	46	176.8
282	0.56214	262914	0.1206	0.99856	46	176.9
283	0.56167	263593	0.1214	0.99811	45	179.1
284	0.56190	263263	0.1223	0.99789	45	182.3
285	0.56195	263195	0.1233	0.99776	45	182.6
286	0.56273	262074	0.1243	0.99796	45	181.4

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
287	0.56272	262093	0.1252	0.99779	45	183.3
288	0.56311	261533	0.1261	0.99801	45	180.4
289	0.56359	260848	0.1271	0.99783	45	182.0
290	0.56531	258390	0.1278	0.99874	46	178.1
291	0.56571	257826	0.1284	0.99881	46	183.1
292	0.56526	258466	0.1291	0.99848	46	185.3
293	0.56543	258219	0.1298	0.99854	46	184.8
294	0.56555	258049	0.1306	0.99824	46	187.4
295	0.56572	257812	0.1314	0.99829	46	187.1
296	0.56675	256358	0.1322	0.99852	46	187.9
297	0.56631	256975	0.1330	0.99831	46	181.9
298	0.56648	256731	0.1338	0.99772	46	190.4
299	0.56773	254974	0.1348	0.99865	46	187.6
300	0.56699	256021	0.1357	0.99800	46	190.2
301	0.56772	254989	0.1366	0.99806	46	190.4
302	0.56872	253589	0.1373	0.99871	46	186.1
303	0.56938	252656	0.1379	0.99866	46	184.4
304	0.56900	253198	0.1386	0.99844	46	187.0
305	0.56956	252410	0.1393	0.99872	46	184.6
306	0.56965	252289	0.1401	0.99827	46	188.6
307	0.57000	251793	0.1408	0.99866	46	186.1
308	0.57038	251268	0.1417	0.99787	46	192.8
309	0.57075	250743	0.1427	0.99807	46	193.1
310	0.57117	250162	0.1436	0.99818	46	192.8
311	0.57125	250048	0.1446	0.99807	46	193.9
312	0.57229	248615	0.1455	0.99831	46	190.3
313	0.57243	248425	0.1463	0.99863	46	186.7
314	0.57287	247812	0.1470	0.99864	46	188.4
315	0.57276	247970	0.1479	0.99805	46	193.8
316	0.57377	246567	0.1487	0.99864	46	188.0
317	0.57364	246746	0.1495	0.99833	46	193.3
318	0.57416	246036	0.1503	0.99816	46	193.1
319	0.57411	246108	0.1513	0.99825	46	190.8
320	0.57457	245479	0.1523	0.99803	46	193.2
321	0.57518	244638	0.1531	0.99842	46	192.5
322	0.57511	244741	0.1541	0.99797	46	194.8
323	0.57608	243412	0.1550	0.99829	46	199.8
324	0.57638	243004	0.1559	0.99818	46	194.8
325	0.57663	242661	0.1569	0.99820	46	201.0
326	0.57681	242417	0.1578	0.99815	46	202.7
327	0.57662	242674	0.1589	0.99769	46	197.9
328	0.57779	241090	0.1600	0.99839	46	200.7
329	0.57799	240818	0.1608	0.99843	46	200.7
330	0.57831	240383	0.1617	0.99829	46	202.2
331	0.57892	239560	0.1626	0.99813	46	203.1
332	0.57962	238621	0.1636	0.99826	46	205.0
333	0.58016	237890	0.1646	0.99823	46	206.3
334	0.58042	237544	0.1657	0.99771	46	208.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
335	0.58062	237274	0.1670	0.99782	46	209.7
336	0.58098	236790	0.1681	0.99809	46	205.6
337	0.58175	235764	0.1690	0.99825	46	204.4
338	0.58175	235769	0.1700	0.99835	46	203.8
339	0.58201	235414	0.1709	0.99801	46	202.8
340	0.58270	234506	0.1719	0.99819	46	207.2
341	0.58296	234150	0.1730	0.99801	46	210.1
342	0.58349	233457	0.1741	0.99791	46	210.1
343	0.58373	233131	0.1754	0.99783	46	212.3
344	0.58435	232316	0.1768	0.99780	46	214.6
345	0.58479	231738	0.1779	0.99801	46	210.3
346	0.58592	230249	0.1792	0.99794	46	213.6
347	0.58631	229736	0.1804	0.99788	46	216.2
348	0.58614	229956	0.1818	0.99753	45	209.9
349	0.58750	228183	0.1834	0.99769	46	218.0
350	0.58785	227716	0.1849	0.99764	45	217.8
351	0.58887	226389	0.1864	0.99768	45	219.7
352	0.58921	225951	0.1882	0.99757	44	217.7
353	0.59049	224296	0.1898	0.99770	45	214.1
354	0.59156	222924	0.1917	0.99763	45	219.9
355	0.59233	221931	0.1938	0.99755	44	224.9
356	0.59394	219875	0.1962	0.99750	43	222.9
357	0.59683	216217	0.2006	0.99807	42	230.1
358	0.59854	214068	0.2049	0.99803	41	230.5
359	0.60044	211696	0.2090	0.99804	42	230.0
360	0.60184	209961	0.2131	0.99804	41	234.2
361	0.60369	207678	0.2172	0.99818	42	232.9
362	0.60537	205631	0.2216	0.99814	41	235.6
363	0.60826	202123	0.2258	0.99844	42	238.9
364	0.61050	199431	0.2302	0.99829	41	246.5
365	0.61284	196648	0.2343	0.99847	42	246.2
366	0.61591	193032	0.2386	0.99867	42	250.9
367	0.61856	189945	0.2429	0.99865	42	251.8

Table C18 Tabulated Results for Cyclic J Specimen GPQ-23

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.49095	380325	0.0122	0.99895	40	109.0
2	0.48968	382722	0.0128	0.99900	45	111.5
3	0.49072	380746	0.0132	0.99933	47	113.2
4	0.49062	380932	0.0135	0.99953	47	114.0
5	0.49176	378797	0.0137	0.99967	47	113.4
6	0.49159	379121	0.0139	0.99967	48	113.1
7	0.49235	377684	0.0141	0.99975	48	114.2
8	0.49268	377069	0.0141	0.99985	49	112.6
9	0.49234	377708	0.0143	0.99981	49	115.3
10	0.49325	375995	0.0144	0.99984	50	113.2
11	0.49316	376171	0.0145	0.99977	51	114.6
12	0.49375	375071	0.0145	0.99987	50	112.2
13	0.49403	374544	0.0146	0.99990	51	114.0
14	0.49375	375077	0.0147	0.99989	51	114.3
15	0.49465	373404	0.0148	0.99989	53	114.2
16	0.49472	373260	0.0149	0.99990	53	113.0
17	0.49499	372768	0.0149	0.99992	55	115.9
18	0.49566	371518	0.0149	0.99993	55	114.5
19	0.49561	371620	0.0150	0.99992	56	113.9
20	0.49579	371286	0.0150	0.99993	57	114.3
21	0.49614	370643	0.0151	0.99993	56	115.6
22	0.49606	370790	0.0151	0.99995	56	115.8
23	0.49628	370372	0.0152	0.99993	57	114.4
24	0.49653	369923	0.0152	0.99995	57	112.8
25	0.49669	369620	0.0153	0.99993	58	115.2
26	0.49677	369468	0.0153	0.99995	58	117.8
27	0.49705	368951	0.0154	0.99993	59	114.4
28	0.49755	368043	0.0155	0.99992	59	119.4
29	0.49768	367800	0.0155	0.99994	60	119.1
30	0.49768	367801	0.0155	0.99994	59	117.2
31	0.49781	367571	0.0156	0.99995	60	116.4
32	0.49828	366698	0.0156	0.99995	60	115.0
33	0.49838	366510	0.0156	0.99996	61	117.8
34	0.49839	366491	0.0156	0.99994	60	117.3
35	0.49878	365782	0.0157	0.99994	61	116.2
36	0.49896	365453	0.0158	0.99995	61	120.1
37	0.49898	365428	0.0158	0.99995	61	119.7
38	0.49956	364356	0.0158	0.99994	62	119.6
39	0.49917	365076	0.0158	0.99995	61	115.9
40	0.49959	364309	0.0158	0.99995	62	115.8
41	0.49980	363933	0.0159	0.99995	62	118.5
42	0.50031	363000	0.0160	0.99995	62	121.2
43	0.50017	363260	0.0160	0.99995	63	120.2
44	0.50031	362993	0.0160	0.99995	62	119.8
45	0.50047	362703	0.0161	0.99995	63	119.1
46	0.50080	362111	0.0162	0.99994	64	118.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
47	0.50086	361998	0.0161	0.99995	62	118.3
48	0.50104	361666	0.0162	0.99995	63	121.3
49	0.50148	360872	0.0162	0.99996	63	118.6
50	0.50159	360671	0.0162	0.99996	64	120.3
51	0.50149	360860	0.0162	0.99996	63	118.9
52	0.50178	360325	0.0163	0.99996	64	117.5
53	0.50189	360127	0.0163	0.99995	65	116.8
54	0.50213	359709	0.0164	0.99995	64	121.8
55	0.50241	359205	0.0165	0.99994	65	119.2
56	0.50241	359206	0.0165	0.99995	64	119.0
57	0.50247	359085	0.0164	0.99995	64	119.9
58	0.50290	358313	0.0165	0.99995	65	119.6
59	0.50333	357551	0.0166	0.99996	65	122.0
60	0.50335	357498	0.0165	0.99996	65	117.7
61	0.50327	357642	0.0167	0.99990	67	120.9
62	0.50382	356670	0.0167	0.99995	65	120.0
63	0.50421	355972	0.0168	0.99995	66	120.0
64	0.50398	356374	0.0168	0.99996	65	119.0
65	0.50419	356009	0.0168	0.99995	66	123.0
66	0.50456	355335	0.0169	0.99996	66	123.7
67	0.50458	355301	0.0169	0.99995	66	123.9
68	0.50469	355110	0.0169	0.99997	66	118.7
69	0.50495	354635	0.0170	0.99995	66	122.1
70	0.50518	354227	0.0169	0.99995	66	122.7
71	0.50501	354538	0.0170	0.99995	66	122.4
72	0.50537	353887	0.0170	0.99995	67	123.9
73	0.50541	353823	0.0171	0.99996	66	121.4
74	0.50565	353398	0.0171	0.99995	67	121.1
75	0.50589	352964	0.0172	0.99995	67	125.1
76	0.50580	353132	0.0171	0.99995	66	120.9
77	0.50617	352472	0.0172	0.99995	66	124.8
78	0.50636	352136	0.0172	0.99995	67	124.2
79	0.50656	351785	0.0172	0.99994	67	124.6
80	0.50665	351616	0.0173	0.99994	67	124.4
81	0.50662	351666	0.0174	0.99992	67	123.1
82	0.50710	350815	0.0174	0.99994	67	123.7
83	0.50736	350356	0.0175	0.99992	68	126.7
84	0.50749	350126	0.0174	0.99994	67	121.5
85	0.50731	350453	0.0175	0.99993	68	126.5
86	0.50766	349832	0.0175	0.99993	67	126.3
87	0.50759	349950	0.0175	0.99994	67	122.7
88	0.50765	349847	0.0175	0.99992	67	120.8
89	0.50788	349433	0.0175	0.99993	67	121.5
90	0.50793	349358	0.0176	0.99994	67	124.9
91	0.50830	348701	0.0176	0.99991	68	122.3
92	0.50852	348316	0.0177	0.99990	69	125.9
93	0.50860	348173	0.0177	0.99991	68	125.1
94	0.50869	348007	0.0178	0.99991	68	124.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
95	0.50887	347692	0.0178	0.99991	68	125.3
96	0.50904	347398	0.0178	0.99993	68	123.4
97	0.50901	347454	0.0179	0.99992	68	123.0
98	0.50947	346651	0.0179	0.99993	68	125.8
99	0.50929	346954	0.0179	0.99992	68	123.3
100	0.50936	346841	0.0179	0.99993	68	123.1
101	0.50953	346540	0.0180	0.99984	69	127.4
102	0.51012	345514	0.0181	0.99989	69	126.5
103	0.50982	346029	0.0181	0.99991	68	122.3
104	0.51018	345401	0.0182	0.99986	69	126.7
105	0.51052	344809	0.0182	0.99990	68	127.1
106	0.51061	344644	0.0183	0.99990	69	125.7
107	0.51029	345212	0.0183	0.99988	69	125.6
108	0.51032	345157	0.0183	0.99990	68	125.4
109	0.51080	344320	0.0184	0.99988	69	124.2
110	0.51091	344126	0.0184	0.99987	69	129.3
111	0.51086	344205	0.0185	0.99987	69	128.0
112	0.51132	343406	0.0185	0.99986	69	129.4
113	0.51100	343969	0.0186	0.99984	69	128.0
114	0.51125	343539	0.0185	0.99987	69	124.4
115	0.51103	343920	0.0187	0.99981	70	130.6
116	0.51119	343633	0.0187	0.99984	69	127.3
117	0.51143	343226	0.0187	0.99988	69	128.2
118	0.51150	343098	0.0187	0.99986	69	127.2
119	0.51168	342779	0.0188	0.99985	69	127.6
120	0.51157	342970	0.0188	0.99983	69	126.8
121	0.51159	342940	0.0189	0.99983	69	127.6
122	0.51162	342886	0.0190	0.99981	70	126.6
123	0.51189	342424	0.0190	0.99979	70	130.7
124	0.51200	342231	0.0190	0.99981	69	128.2
125	0.51221	341863	0.0190	0.99982	69	125.6
126	0.51253	341312	0.0191	0.99982	70	126.0
127	0.51231	341691	0.0191	0.99980	70	127.4
128	0.51277	340887	0.0192	0.99976	70	130.6
129	0.51202	342195	0.0192	0.99972	70	129.7
130	0.51133	343390	0.0192	0.99963	70	128.5
131	0.51138	343297	0.0192	0.99965	69	128.9
132	0.51233	341659	0.0193	0.99970	70	128.5
133	0.51226	341771	0.0193	0.99973	70	128.2
134	0.51235	341628	0.0194	0.99971	70	129.0
135	0.51207	342110	0.0194	0.99968	70	128.5
136	0.51241	341521	0.0195	0.99968	70	128.9
137	0.51215	341969	0.0195	0.99966	70	127.5
138	0.51208	342083	0.0196	0.99964	70	126.9
139	0.51251	341349	0.0196	0.99966	70	127.8
140	0.51232	341677	0.0197	0.99967	70	126.6
141	0.51252	341319	0.0198	0.99966	70	127.4
142	0.51243	341489	0.0197	0.99966	70	129.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
143	0.51231	341693	0.0199	0.99966	71	131.4
144	0.51223	341830	0.0199	0.99964	71	129.7
145	0.51242	341505	0.0199	0.99966	70	126.7
146	0.51245	341449	0.0199	0.99968	70	126.2
147	0.51230	341711	0.0200	0.99966	70	130.2
148	0.51277	340892	0.0201	0.99966	71	130.4
149	0.51249	341371	0.0201	0.99965	71	131.9
150	0.51246	341425	0.0202	0.99965	70	129.7
151	0.51266	341090	0.0203	0.99964	71	129.6
152	0.51276	340909	0.0202	0.99969	70	125.4
153	0.51269	341034	0.0202	0.99969	70	125.5
154	0.51286	340734	0.0204	0.99970	70	129.7
155	0.51312	340282	0.0204	0.99967	71	128.9
156	0.51319	340166	0.0204	0.99970	70	129.2
157	0.51317	340207	0.0205	0.99968	71	129.7
158	0.51319	340170	0.0205	0.99969	71	127.9
159	0.51298	340532	0.0206	0.99968	70	128.4
160	0.51345	339711	0.0206	0.99964	71	128.1
161	0.51327	340028	0.0207	0.99967	71	128.4
162	0.51347	339685	0.0207	0.99968	71	128.4
163	0.51341	339791	0.0207	0.99970	70	127.9
164	0.51368	339314	0.0207	0.99974	70	126.6
165	0.51379	339130	0.0208	0.99969	71	127.9
166	0.51383	339053	0.0209	0.99970	71	127.7
167	0.51354	339568	0.0209	0.99971	71	128.2
168	0.51372	339244	0.0210	0.99975	70	128.1
169	0.51399	338783	0.0210	0.99972	71	126.6
170	0.51403	338722	0.0211	0.99972	71	130.9
171	0.51419	338438	0.0211	0.99973	71	131.2
172	0.51413	338539	0.0211	0.99976	70	127.3
173	0.51425	338338	0.0212	0.99975	70	126.4
174	0.51440	338079	0.0212	0.99974	71	130.9
175	0.51408	338633	0.0213	0.99973	71	130.2
176	0.51442	338039	0.0214	0.99972	72	133.8
177	0.51461	337717	0.0214	0.99972	71	131.0
178	0.51469	337571	0.0215	0.99972	71	131.1
179	0.51466	337624	0.0215	0.99977	71	126.9
180	0.51503	337003	0.0215	0.99977	71	126.5
181	0.51488	337252	0.0216	0.99970	72	131.5
182	0.51485	337306	0.0217	0.99974	71	130.2
183	0.51502	337017	0.0218	0.99974	71	130.3
184	0.51526	336607	0.0218	0.99973	72	130.1
185	0.51551	336169	0.0219	0.99976	72	132.4
186	0.51508	336916	0.0219	0.99975	71	129.2
187	0.51526	336607	0.0220	0.99971	71	133.7
188	0.51504	336973	0.0221	0.99973	71	129.0
189	0.51510	336878	0.0222	0.99975	71	129.6
190	0.51569	335856	0.0222	0.99976	72	129.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
191	0.51594	335429	0.0222	0.99978	72	133.3
192	0.51567	335897	0.0222	0.99979	71	129.1
193	0.51568	335883	0.0224	0.99972	71	134.0
194	0.51630	334812	0.0223	0.99978	71	130.2
195	0.51634	334753	0.0224	0.99978	71	129.6
196	0.51607	335205	0.0224	0.99979	71	128.9
197	0.51625	334902	0.0226	0.99976	71	133.0
198	0.51627	334877	0.0226	0.99977	71	133.2
199	0.51644	334582	0.0227	0.99973	71	133.0
200	0.51666	334197	0.0227	0.99975	72	129.9
201	0.51632	334787	0.0228	0.99969	72	131.9
202	0.51685	333881	0.0229	0.99975	71	132.7
203	0.51689	333808	0.0229	0.99974	71	131.9
204	0.51673	334088	0.0230	0.99974	71	132.7
205	0.51702	333597	0.0230	0.99974	72	131.7
206	0.51724	333214	0.0230	0.99976	72	128.7
207	0.51731	333103	0.0231	0.99976	71	131.5
208	0.51760	332602	0.0231	0.99975	71	129.3
209	0.51737	332995	0.0233	0.99972	72	131.6
210	0.51772	332399	0.0234	0.99972	72	131.8
211	0.51725	333201	0.0234	0.99967	72	131.7
212	0.51780	332267	0.0235	0.99969	72	135.2
213	0.51794	332028	0.0235	0.99972	71	132.1
214	0.51819	331598	0.0235	0.99972	71	131.2
215	0.51815	331674	0.0236	0.99971	72	130.9
216	0.51832	331373	0.0237	0.99968	72	131.6
217	0.51829	331439	0.0238	0.99962	72	135.1
218	0.51854	331002	0.0238	0.99972	71	131.5
219	0.51866	330812	0.0238	0.99968	71	131.4
220	0.51883	330520	0.0239	0.99971	71	131.8
221	0.51891	330389	0.0239	0.99969	72	131.7
222	0.51899	330238	0.0240	0.99965	72	135.4
223	0.51912	330034	0.0240	0.99970	72	130.5
224	0.51913	330010	0.0241	0.99963	72	135.7
225	0.51896	330295	0.0242	0.99963	72	135.1
226	0.51937	329609	0.0243	0.99961	72	135.6
227	0.51941	329542	0.0243	0.99959	72	135.1
228	0.51928	329761	0.0244	0.99950	73	133.1
229	0.51919	329914	0.0245	0.99962	71	131.8
230	0.51993	328661	0.0246	0.99954	72	137.2
231	0.51965	329135	0.0246	0.99959	72	135.2
232	0.51953	329340	0.0246	0.99962	72	134.5
233	0.51971	329037	0.0247	0.99961	72	134.6
234	0.51937	329609	0.0248	0.99962	72	133.6
235	0.51997	328594	0.0248	0.99959	72	134.3
236	0.51993	328667	0.0248	0.99953	72	134.4
237	0.51940	329556	0.0250	0.99955	72	134.7
238	0.51940	329554	0.0250	0.99959	72	133.2

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
239	0.51950	329384	0.0251	0.99959	72	133.1
240	0.51953	329340	0.0252	0.99951	73	136.1
241	0.51962	329182	0.0253	0.99959	72	133.8
242	0.51917	329950	0.0254	0.99958	72	133.0
243	0.51957	329263	0.0255	0.99960	72	132.4
244	0.51953	329330	0.0256	0.99951	73	137.4
245	0.51951	329375	0.0257	0.99961	72	133.2
246	0.51942	329528	0.0257	0.99964	72	132.2
247	0.51977	328923	0.0257	0.99965	72	131.5
248	0.51944	329479	0.0259	0.99962	72	136.7
249	0.51963	329160	0.0260	0.99961	72	132.8
250	0.51997	328600	0.0260	0.99968	72	132.5
251	0.52019	328222	0.0260	0.99968	72	132.1
252	0.52030	328044	0.0261	0.99963	73	132.6
253	0.52001	328531	0.0262	0.99968	72	130.9
254	0.52038	327903	0.0263	0.99966	73	135.7
255	0.52043	327819	0.0263	0.99967	72	132.4
256	0.52055	327621	0.0264	0.99969	72	132.3
257	0.52086	327097	0.0264	0.99969	72	132.1
258	0.52062	327505	0.0265	0.99970	72	131.3
259	0.52070	327355	0.0266	0.99969	73	136.2
260	0.52122	326485	0.0267	0.99970	73	136.3
261	0.52083	327153	0.0267	0.99976	72	135.9
262	0.52084	327128	0.0268	0.99964	73	133.7
263	0.52127	326406	0.0269	0.99974	72	135.0
264	0.52115	326609	0.0270	0.99972	72	136.1
265	0.52143	326134	0.0270	0.99977	72	135.4
266	0.52135	326273	0.0272	0.99973	72	137.6
267	0.52160	325852	0.0273	0.99973	73	135.3
268	0.52183	325465	0.0274	0.99976	73	135.3
269	0.52224	324783	0.0274	0.99977	73	136.0
270	0.52260	324184	0.0275	0.99978	73	135.6
271	0.52194	325288	0.0276	0.99972	72	135.4
272	0.52231	324672	0.0277	0.99976	72	136.1
273	0.52274	323947	0.0278	0.99980	72	135.5
274	0.52280	323849	0.0279	0.99977	72	135.0
275	0.52309	323360	0.0279	0.99978	73	138.3
276	0.52330	323010	0.0280	0.99980	73	135.5
277	0.52373	322301	0.0281	0.99979	73	135.7
278	0.52413	321635	0.0282	0.99978	73	137.9
279	0.52416	321585	0.0283	0.99980	73	139.4
280	0.52418	321552	0.0284	0.99980	72	136.9
281	0.52427	321398	0.0285	0.99980	72	136.1
282	0.52490	320357	0.0285	0.99981	72	136.4
283	0.52500	320198	0.0286	0.99982	72	136.4
284	0.52515	319955	0.0286	0.99982	73	136.6
285	0.52522	319835	0.0288	0.99977	73	140.6
286	0.52541	319519	0.0289	0.99978	73	136.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
287	0.52601	318524	0.0289	0.99981	73	136.4
288	0.52598	318573	0.0290	0.99982	72	137.7
289	0.52604	318481	0.0291	0.99982	72	136.4
290	0.52658	317589	0.0292	0.99986	72	136.5
291	0.52659	317580	0.0293	0.99975	73	141.7
292	0.52689	317091	0.0294	0.99982	73	140.9
293	0.52702	316868	0.0295	0.99976	73	140.8
294	0.52762	315895	0.0296	0.99981	73	140.3
295	0.52777	315639	0.0297	0.99981	73	141.9
296	0.52781	315578	0.0298	0.99981	73	141.2
297	0.52839	314622	0.0299	0.99980	73	138.6
298	0.52827	314827	0.0300	0.99977	73	142.0
299	0.52848	314489	0.0301	0.99980	73	141.4
300	0.52882	313932	0.0302	0.99978	73	141.9
301	0.52909	313486	0.0303	0.99980	73	141.7
302	0.52932	313118	0.0304	0.99982	72	142.2
303	0.52928	313180	0.0305	0.99972	73	141.4
304	0.52899	313648	0.0307	0.99972	73	145.7
305	0.52964	312600	0.0307	0.99975	73	142.3
306	0.52991	312160	0.0308	0.99982	72	141.6
307	0.52984	312268	0.0310	0.99974	73	145.9
308	0.53046	311264	0.0310	0.99979	73	140.7
309	0.53069	310893	0.0311	0.99982	73	141.2
310	0.53069	310892	0.0312	0.99975	73	141.7
311	0.53131	309888	0.0313	0.99979	73	142.4
312	0.53091	310539	0.0315	0.99969	73	147.3
313	0.53125	309989	0.0316	0.99977	73	141.8
314	0.53159	309431	0.0317	0.99976	73	145.3
315	0.53169	309277	0.0318	0.99975	73	144.0
316	0.53168	309285	0.0320	0.99971	73	147.4
317	0.53198	308810	0.0320	0.99979	73	142.7
318	0.53253	307921	0.0321	0.99978	73	142.1
319	0.53265	307733	0.0322	0.99978	73	142.7
320	0.53246	308033	0.0324	0.99973	73	147.2
321	0.53276	307560	0.0324	0.99976	73	142.4
322	0.53271	307628	0.0326	0.99971	73	146.7
323	0.53277	307542	0.0327	0.99976	73	146.6
324	0.53304	307110	0.0328	0.99970	74	145.7
325	0.53342	306492	0.0329	0.99977	73	142.8
326	0.53333	306645	0.0330	0.99972	74	146.3
327	0.53363	306154	0.0331	0.99977	73	142.8
328	0.53383	305838	0.0333	0.99966	74	147.3
329	0.53390	305725	0.0333	0.99974	73	146.6
330	0.53386	305797	0.0335	0.99965	74	148.3
331	0.53419	305267	0.0337	0.99968	74	147.8
332	0.53424	305194	0.0338	0.99970	74	146.9
333	0.53442	304898	0.0339	0.99973	73	146.9
334	0.53455	304695	0.0341	0.99968	74	146.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
335	0.53464	304553	0.0341	0.99974	73	146.7
336	0.53468	304487	0.0342	0.99976	73	146.4
337	0.53458	304642	0.0344	0.99969	74	147.2
338	0.53485	304211	0.0345	0.99976	73	146.0
339	0.53522	303624	0.0346	0.99973	73	146.7
340	0.53513	303770	0.0347	0.99962	74	146.1
341	0.53508	303853	0.0350	0.99962	74	147.4
342	0.53524	303600	0.0351	0.99961	74	150.0
343	0.53512	303786	0.0353	0.99957	74	149.7
344	0.53543	303285	0.0356	0.99965	74	151.8
345	0.53595	302464	0.0356	0.99969	73	147.1
346	0.53575	302785	0.0358	0.99969	74	150.1
347	0.53607	302273	0.0359	0.99972	74	146.6
348	0.53620	302063	0.0360	0.99957	74	150.0
349	0.53598	302426	0.0362	0.99963	74	150.4
350	0.53623	302030	0.0364	0.99966	73	149.1
351	0.53664	301375	0.0365	0.99970	73	148.7
352	0.53670	301270	0.0367	0.99968	73	151.4
353	0.53688	301001	0.0367	0.99975	73	149.3
354	0.53680	301127	0.0369	0.99973	73	148.2
355	0.53739	300184	0.0369	0.99975	73	148.3
356	0.53732	300304	0.0372	0.99971	74	152.3
357	0.53715	300564	0.0372	0.99973	73	149.7
358	0.53745	300092	0.0374	0.99963	74	149.9
359	0.53783	299488	0.0375	0.99971	74	150.2
360	0.53796	299295	0.0376	0.99972	73	149.0
361	0.53806	299134	0.0377	0.99974	73	150.7
362	0.53803	299176	0.0379	0.99967	74	149.9
363	0.53788	299422	0.0381	0.99964	74	150.4
364	0.53794	299323	0.0383	0.99960	74	150.7
365	0.53819	298928	0.0384	0.99958	74	148.6
366	0.53822	298881	0.0387	0.99957	74	150.5
367	0.53853	298400	0.0389	0.99962	74	150.4
368	0.53864	298226	0.0390	0.99957	75	153.2
369	0.53892	297782	0.0391	0.99969	74	149.7
370	0.53911	297485	0.0394	0.99964	74	151.9
371	0.53904	297591	0.0396	0.99961	74	150.7
372	0.53958	296751	0.0396	0.99970	74	150.3
373	0.53948	296913	0.0398	0.99965	74	150.7
374	0.54013	295889	0.0399	0.99971	74	150.0
375	0.53981	296391	0.0401	0.99966	74	149.9
376	0.54016	295847	0.0402	0.99966	74	151.2
377	0.54036	295530	0.0404	0.99965	74	155.3
378	0.53984	296339	0.0406	0.99962	74	154.2
379	0.54070	294995	0.0407	0.99969	74	150.2
380	0.54043	295418	0.0409	0.99964	74	151.6
381	0.54067	295044	0.0411	0.99967	74	155.3
382	0.54104	294470	0.0411	0.99969	74	154.7

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
383	0.54110	294384	0.0413	0.99970	74	154.4
384	0.54089	294700	0.0415	0.99959	74	156.2
385	0.54129	294079	0.0416	0.99969	73	152.7
386	0.54089	294697	0.0418	0.99957	74	154.6
387	0.54167	293496	0.0420	0.99965	74	155.2
388	0.54172	293414	0.0421	0.99973	73	150.7
389	0.54242	292327	0.0423	0.99973	74	155.9
390	0.54227	292569	0.0424	0.99967	74	155.7
391	0.54208	292849	0.0426	0.99953	75	155.2
392	0.54255	292130	0.0428	0.99967	74	152.3
393	0.54282	291708	0.0430	0.99970	74	155.6
394	0.54258	292083	0.0431	0.99965	74	155.3
395	0.54302	291404	0.0433	0.99966	74	156.2
396	0.54301	291423	0.0435	0.99961	74	156.4
397	0.54339	290827	0.0437	0.99962	74	156.7
398	0.54329	290991	0.0438	0.99963	73	157.7
399	0.54379	290217	0.0440	0.99967	74	156.9
400	0.54379	290222	0.0442	0.99963	74	156.7
401	0.54363	290464	0.0443	0.99962	74	157.5
402	0.54379	290220	0.0446	0.99956	75	159.2
403	0.54347	290709	0.0447	0.99948	74	154.7
404	0.54427	289475	0.0450	0.99960	74	156.4
405	0.54437	289322	0.0452	0.99957	74	157.2
406	0.54453	289072	0.0453	0.99962	74	155.7
407	0.54440	289273	0.0455	0.99956	74	156.9
408	0.54495	288430	0.0457	0.99961	74	156.1
409	0.54481	288643	0.0459	0.99961	74	159.9
410	0.54442	289242	0.0461	0.99949	74	160.8
411	0.54495	288434	0.0463	0.99958	74	160.6
412	0.54522	288012	0.0465	0.99963	74	156.4
413	0.54533	287850	0.0467	0.99959	74	157.8
414	0.54517	288102	0.0469	0.99943	75	160.0
415	0.54541	287724	0.0470	0.99957	75	157.8
416	0.54489	288532	0.0473	0.99952	74	155.9
417	0.54554	287535	0.0475	0.99960	74	158.4
418	0.54521	288027	0.0477	0.99958	74	159.9
419	0.54560	287431	0.0479	0.99959	74	159.6
420	0.54559	287447	0.0481	0.99957	74	160.9
421	0.54590	286983	0.0483	0.99960	74	160.2
422	0.54583	287088	0.0485	0.99959	74	160.3
423	0.54604	286771	0.0487	0.99954	74	160.7
424	0.54639	286229	0.0489	0.99960	74	159.3
425	0.54688	285482	0.0490	0.99970	74	158.0
426	0.54666	285824	0.0493	0.99959	75	160.9
427	0.54662	285885	0.0494	0.99961	74	157.0
428	0.54718	285034	0.0496	0.99966	74	159.4
429	0.54680	285608	0.0497	0.99960	74	159.9
430	0.54715	285073	0.0499	0.99962	74	160.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
431	0.54720	285002	0.0501	0.99961	74	160.4
432	0.54760	284392	0.0503	0.99963	74	159.5
433	0.54777	284128	0.0504	0.99961	74	160.2
434	0.54798	283815	0.0506	0.99966	74	160.5
435	0.54824	283428	0.0508	0.99967	74	160.7
436	0.54794	283873	0.0509	0.99964	74	160.4
437	0.54795	283854	0.0512	0.99959	74	162.6
438	0.54822	283448	0.0513	0.99954	75	159.3
439	0.54828	283356	0.0516	0.99956	74	160.6
440	0.54860	282872	0.0518	0.99960	74	159.7
441	0.54871	282716	0.0520	0.99960	74	160.0
442	0.54872	282702	0.0522	0.99949	75	161.3
443	0.54907	282170	0.0524	0.99958	74	160.6
444	0.54930	281818	0.0526	0.99957	74	160.5
445	0.54974	281152	0.0528	0.99961	74	160.4
446	0.54898	282308	0.0532	0.99942	74	161.4
447	0.54984	281004	0.0533	0.99954	74	160.8
448	0.55023	280414	0.0535	0.99962	74	160.4
449	0.55003	280720	0.0538	0.99950	74	162.6
450	0.55031	280297	0.0540	0.99956	74	163.3
451	0.55003	280722	0.0543	0.99942	75	165.8
452	0.55040	280165	0.0545	0.99961	75	161.6
453	0.55048	280043	0.0548	0.99945	75	163.7
454	0.55052	279977	0.0551	0.99949	74	165.5
455	0.55058	279901	0.0553	0.99953	74	165.0
456	0.55055	279933	0.0556	0.99948	74	162.7
457	0.55092	279380	0.0559	0.99947	74	167.7
458	0.55125	278892	0.0561	0.99953	74	163.4
459	0.55160	278364	0.0563	0.99951	75	165.6
460	0.55184	278015	0.0566	0.99962	75	164.7
461	0.55193	277866	0.0568	0.99961	74	161.3
462	0.55188	277950	0.0571	0.99951	74	166.4
463	0.55185	277998	0.0574	0.99951	74	167.2
464	0.55192	277891	0.0577	0.99946	74	166.7
465	0.55220	277470	0.0578	0.99952	74	163.7
466	0.55277	276627	0.0581	0.99961	74	165.7
467	0.55262	276851	0.0583	0.99949	75	165.1
468	0.55290	276425	0.0585	0.99947	75	165.7
469	0.55303	276241	0.0588	0.99957	74	165.6
470	0.55298	276307	0.0591	0.99946	75	165.4
471	0.55303	276242	0.0594	0.99947	74	166.6
472	0.55360	275389	0.0596	0.99962	74	167.1
473	0.55352	275506	0.0598	0.99956	74	167.8
474	0.55351	275528	0.0600	0.99952	75	165.0
475	0.55412	274620	0.0602	0.99956	75	166.1
476	0.55360	275391	0.0606	0.99944	74	165.9
477	0.55389	274956	0.0609	0.99938	75	166.7
478	0.55433	274301	0.0612	0.99947	74	166.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
479	0.55435	274278	0.0615	0.99946	74	167.6
480	0.55447	274096	0.0618	0.99943	74	169.2
481	0.55463	273858	0.0620	0.99949	75	167.2
482	0.55491	273448	0.0624	0.99946	75	170.2
483	0.55492	273431	0.0626	0.99955	74	166.5
484	0.55523	272974	0.0628	0.99954	75	169.0
485	0.55540	272733	0.0631	0.99953	75	170.3
486	0.55505	273238	0.0634	0.99946	74	171.5
487	0.55560	272433	0.0636	0.99963	75	165.3
488	0.55552	272551	0.0639	0.99942	75	171.4
489	0.55624	271498	0.0640	0.99959	75	169.7
490	0.55563	272382	0.0642	0.99949	75	168.1
491	0.55643	271205	0.0644	0.99966	75	167.2
492	0.55644	271199	0.0647	0.99955	75	169.8
493	0.55661	270952	0.0650	0.99948	75	168.9
494	0.55680	270662	0.0653	0.99950	75	171.0
495	0.55683	270632	0.0656	0.99946	75	171.4
496	0.55763	269462	0.0658	0.99962	75	171.9
497	0.55729	269957	0.0660	0.99957	75	169.8
498	0.55722	270054	0.0664	0.99943	75	171.4
499	0.55808	268791	0.0666	0.99959	75	171.2
500	0.55801	268906	0.0668	0.99956	75	171.6
501	0.55788	269090	0.0671	0.99942	75	173.5
502	0.55801	268902	0.0674	0.99951	75	171.7
503	0.55773	269311	0.0678	0.99941	75	171.8
504	0.55863	267996	0.0679	0.99954	75	171.0
505	0.55848	268213	0.0682	0.99944	75	171.2
506	0.55894	267548	0.0685	0.99952	75	170.5
507	0.55846	268241	0.0687	0.99947	75	169.7
508	0.55902	267433	0.0690	0.99956	75	170.4
509	0.55881	267728	0.0693	0.99943	75	175.2
510	0.55907	267360	0.0695	0.99958	75	170.0
511	0.55942	266843	0.0697	0.99958	75	171.1
512	0.55903	267420	0.0700	0.99944	75	173.4
513	0.55936	266933	0.0703	0.99948	75	171.6
514	0.55899	267474	0.0706	0.99941	75	175.8
515	0.55941	266868	0.0709	0.99949	75	172.6
516	0.55947	266775	0.0712	0.99948	75	175.0
517	0.55963	266538	0.0715	0.99948	75	173.0
518	0.56002	265975	0.0718	0.99954	76	177.0
519	0.56016	265775	0.0720	0.99961	75	174.8
520	0.56060	265141	0.0722	0.99962	75	175.1
521	0.56006	265924	0.0725	0.99950	75	176.0
522	0.56022	265689	0.0728	0.99952	75	176.2
523	0.56043	265389	0.0730	0.99950	75	175.1
524	0.56099	264571	0.0733	0.99954	75	173.3
525	0.56087	264754	0.0736	0.99943	75	178.8
526	0.56106	264474	0.0739	0.99948	75	176.5

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
527	0.56120	264270	0.0742	0.99951	75	176.7
528	0.56173	263504	0.0744	0.99957	75	175.6
529	0.56119	264283	0.0746	0.99942	76	175.6
530	0.56153	263802	0.0750	0.99951	75	175.4
531	0.56158	263730	0.0754	0.99948	75	176.5
532	0.56204	263057	0.0756	0.99960	75	176.7
533	0.56232	262658	0.0758	0.99952	76	176.2
534	0.56214	262922	0.0762	0.99940	76	177.2
535	0.56254	262348	0.0764	0.99956	75	176.0
536	0.56249	262417	0.0766	0.99951	75	179.3
537	0.56272	262084	0.0769	0.99950	76	176.6
538	0.56259	262277	0.0773	0.99943	75	176.3
539	0.56261	262240	0.0776	0.99946	75	179.7
540	0.56301	261668	0.0778	0.99959	75	176.5
541	0.56342	261089	0.0781	0.99951	76	181.1
542	0.56324	261346	0.0784	0.99945	75	180.9
543	0.56317	261450	0.0787	0.99947	75	179.2
544	0.56328	261293	0.0790	0.99937	75	177.6
545	0.56356	260884	0.0794	0.99950	75	181.4
546	0.56371	260676	0.0797	0.99948	75	177.8
547	0.56410	260117	0.0799	0.99955	76	181.4
548	0.56436	259749	0.0803	0.99950	76	181.0
549	0.56422	259943	0.0806	0.99941	76	178.9
550	0.56433	259784	0.0808	0.99948	75	180.4
551	0.56459	259415	0.0811	0.99948	75	180.3
552	0.56479	259127	0.0814	0.99945	76	180.9
553	0.56511	258674	0.0818	0.99945	76	184.1
554	0.56507	258739	0.0821	0.99953	76	182.0
555	0.56529	258425	0.0823	0.99945	76	181.1
556	0.56542	258242	0.0826	0.99959	75	177.7
557	0.56546	258179	0.0828	0.99959	76	180.4
558	0.56575	257773	0.0832	0.99947	76	181.5
559	0.56553	258084	0.0834	0.99942	76	180.8
560	0.56607	257320	0.0838	0.99953	76	180.7
561	0.56615	257201	0.0840	0.99959	75	178.2
562	0.56640	256849	0.0842	0.99960	76	179.3
563	0.56618	257162	0.0845	0.99944	76	184.9
564	0.56632	256955	0.0849	0.99937	76	185.2
565	0.56668	256450	0.0851	0.99950	75	181.8
566	0.56669	256440	0.0854	0.99958	75	183.1
567	0.56699	256016	0.0856	0.99957	76	180.7
568	0.56683	256235	0.0860	0.99947	76	182.0
569	0.56696	256059	0.0863	0.99935	76	182.5
570	0.56730	255578	0.0867	0.99946	76	186.5
571	0.56763	255117	0.0869	0.99952	76	184.9
572	0.56793	254690	0.0872	0.99958	76	180.3
573	0.56770	255011	0.0875	0.99951	75	184.1
574	0.56816	254366	0.0879	0.99949	76	187.1

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
575	0.56830	254176	0.0881	0.99948	76	186.4
576	0.56857	253792	0.0885	0.99947	76	183.7
577	0.56884	253421	0.0887	0.99956	76	185.8
578	0.56876	253529	0.0890	0.99948	75	184.5
579	0.56871	253595	0.0893	0.99946	76	186.4
580	0.56897	253236	0.0897	0.99946	76	186.6
581	0.56950	252499	0.0899	0.99947	76	184.6
582	0.56917	252949	0.0903	0.99935	76	187.3
583	0.56926	252821	0.0906	0.99944	76	188.0
584	0.56964	252303	0.0909	0.99944	76	187.4
585	0.56981	252059	0.0913	0.99948	76	186.3
586	0.56983	252035	0.0916	0.99942	76	188.6
587	0.57004	251739	0.0919	0.99940	76	188.9
588	0.57027	251424	0.0922	0.99953	76	189.5
589	0.57005	251725	0.0925	0.99936	77	186.7
590	0.57075	250747	0.0928	0.99958	76	186.4
591	0.57047	251138	0.0931	0.99946	76	188.6
592	0.57076	250735	0.0933	0.99956	77	185.2
593	0.57084	250624	0.0936	0.99949	76	186.5
594	0.57081	250670	0.0939	0.99954	76	187.2
595	0.57136	249901	0.0941	0.99955	76	187.4
596	0.57115	250197	0.0944	0.99952	76	187.5
597	0.57130	249979	0.0947	0.99954	76	185.7
598	0.57124	250066	0.0950	0.99948	76	186.5
599	0.57168	249457	0.0953	0.99952	77	189.5
600	0.57129	250000	0.0956	0.99939	76	186.9
601	0.57164	249518	0.0959	0.99946	76	187.3
602	0.57200	249014	0.0962	0.99951	77	189.6
603	0.57236	248521	0.0965	0.99951	76	187.0
604	0.57221	248730	0.0968	0.99939	77	192.4
605	0.57251	248316	0.0971	0.99948	76	192.0
606	0.57234	248545	0.0974	0.99944	76	187.8
607	0.57266	248109	0.0977	0.99954	76	187.3
608	0.57263	248140	0.0980	0.99950	76	187.6
609	0.57278	247932	0.0984	0.99933	77	192.4
610	0.57250	248328	0.0988	0.99931	76	192.2
611	0.57241	248444	0.0992	0.99895	76	192.6
612	0.57351	246936	0.0998	0.99946	76	191.6
613	0.57334	247169	0.1003	0.99935	76	190.9
614	0.57315	247431	0.1007	0.99934	76	192.0
615	0.57376	246590	0.1010	0.99945	76	193.1
616	0.57431	245827	0.1013	0.99955	77	190.7
617	0.57422	245958	0.1016	0.99947	76	192.3
618	0.57428	245873	0.1018	0.99942	77	189.6
619	0.57417	246025	0.1022	0.99947	76	191.9
620	0.57440	245714	0.1026	0.99943	76	194.2
621	0.57476	245215	0.1029	0.99948	76	191.3
622	0.57522	244587	0.1032	0.99952	77	194.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
623	0.57504	244828	0.1035	0.99939	77	192.0
624	0.57533	244433	0.1039	0.99942	77	196.1
625	0.57501	244875	0.1042	0.99925	77	192.7
626	0.57591	243646	0.1047	0.99950	77	197.1
627	0.57559	244079	0.1050	0.99937	77	194.7
628	0.57575	243856	0.1054	0.99944	76	196.8
629	0.57593	243612	0.1057	0.99939	77	195.8
630	0.57588	243687	0.1062	0.99940	76	194.0
631	0.57641	242969	0.1064	0.99950	77	192.0
632	0.57625	243182	0.1068	0.99938	77	196.8
633	0.57670	242569	0.1072	0.99935	77	199.6
634	0.57704	242108	0.1075	0.99951	77	197.0
635	0.57715	241952	0.1078	0.99948	77	194.2
636	0.57686	242351	0.1082	0.99937	77	196.8
637	0.57734	241692	0.1085	0.99939	77	195.1
638	0.57726	241811	0.1089	0.99939	77	198.5
639	0.57714	241972	0.1092	0.99933	76	193.5
640	0.57795	240867	0.1094	0.99956	77	196.1
641	0.57769	241223	0.1098	0.99937	77	198.4
642	0.57794	240887	0.1101	0.99944	76	197.3
643	0.57810	240668	0.1104	0.99950	77	196.6
644	0.57848	240162	0.1107	0.99950	77	194.9
645	0.57821	240515	0.1110	0.99943	77	198.4
646	0.57844	240204	0.1114	0.99937	77	198.8
647	0.57870	239864	0.1117	0.99949	77	197.5
648	0.57866	239907	0.1121	0.99932	77	199.6
649	0.57912	239294	0.1125	0.99937	77	201.4
650	0.57884	239675	0.1128	0.99943	77	201.0
651	0.57912	239285	0.1131	0.99939	77	196.6
652	0.57951	238764	0.1135	0.99948	77	200.0
653	0.57930	239046	0.1140	0.99935	77	202.2
654	0.57992	238219	0.1143	0.99947	77	198.8
655	0.57994	238183	0.1146	0.99938	78	202.9
656	0.58017	237881	0.1150	0.99936	77	201.1
657	0.58028	237727	0.1154	0.99944	78	202.3
658	0.58070	237166	0.1157	0.99945	77	199.1
659	0.58091	236893	0.1160	0.99952	77	202.2
660	0.58077	237075	0.1164	0.99952	77	203.4
661	0.58059	237316	0.1168	0.99936	77	203.1
662	0.58110	236629	0.1171	0.99946	77	203.1
663	0.58101	236749	0.1175	0.99936	77	203.2
664	0.58121	236487	0.1179	0.99930	78	202.5
665	0.58157	236012	0.1182	0.99952	77	201.0
666	0.58199	235440	0.1185	0.99953	78	201.5
667	0.58161	235947	0.1188	0.99950	77	202.6
668	0.58175	235764	0.1192	0.99935	78	202.9
669	0.58212	235266	0.1195	0.99948	77	203.5
670	0.58212	235268	0.1199	0.99938	78	202.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
671	0.58234	234977	0.1202	0.99946	77	204.0
672	0.58216	235222	0.1207	0.99936	77	206.8
673	0.58262	234604	0.1210	0.99946	77	204.7
674	0.58252	234745	0.1213	0.99943	77	201.9
675	0.58294	234185	0.1216	0.99947	77	203.3
676	0.58285	234301	0.1220	0.99936	77	206.6
677	0.58323	233800	0.1224	0.99935	78	208.6
678	0.58337	233612	0.1228	0.99946	77	202.9
679	0.58339	233586	0.1231	0.99942	77	204.1
680	0.58329	233714	0.1235	0.99934	77	206.4
681	0.58348	233465	0.1239	0.99943	77	207.7
682	0.58402	232755	0.1243	0.99938	78	208.3
683	0.58417	232548	0.1246	0.99945	77	204.8
684	0.58435	232311	0.1250	0.99938	78	207.4
685	0.58476	231768	0.1253	0.99950	78	205.1
686	0.58473	231819	0.1257	0.99937	78	207.1
687	0.58471	231841	0.1261	0.99931	78	207.4
688	0.58517	231238	0.1265	0.99946	78	209.1
689	0.58512	231293	0.1269	0.99937	78	207.5
690	0.58538	230963	0.1272	0.99942	78	205.3
691	0.58559	230687	0.1276	0.99941	78	208.5
692	0.58562	230642	0.1280	0.99944	78	208.0
693	0.58594	230227	0.1283	0.99943	78	209.0
694	0.58607	230050	0.1287	0.99932	78	209.4
695	0.58593	230230	0.1291	0.99938	78	210.4
696	0.58631	229742	0.1295	0.99936	78	211.5
697	0.58628	229781	0.1299	0.99938	78	207.8
698	0.58623	229835	0.1303	0.99935	77	212.1
699	0.58693	228929	0.1307	0.99940	78	208.2
700	0.58672	229201	0.1311	0.99939	78	213.8
701	0.58686	229012	0.1316	0.99934	78	210.7
702	0.58727	228482	0.1320	0.99941	78	214.1
703	0.58746	228227	0.1324	0.99940	77	213.4
704	0.58791	227639	0.1329	0.99932	78	217.3
705	0.58801	227516	0.1333	0.99940	78	213.6
706	0.58836	227055	0.1338	0.99934	78	213.6
707	0.58868	226643	0.1341	0.99943	78	213.8
708	0.58840	227007	0.1345	0.99935	78	213.3
709	0.58884	226433	0.1350	0.99931	78	214.0
710	0.58893	226321	0.1354	0.99929	78	217.0
711	0.58904	226172	0.1359	0.99933	78	215.3
712	0.58938	225735	0.1363	0.99933	78	215.0
713	0.58928	225869	0.1367	0.99936	78	213.4
714	0.58957	225491	0.1371	0.99929	78	216.5
715	0.58992	225030	0.1375	0.99935	78	216.3
716	0.59003	224887	0.1380	0.99934	78	214.2
717	0.58959	225461	0.1384	0.99925	78	213.7
718	0.59018	224703	0.1390	0.99927	78	218.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
719	0.59040	224412	0.1395	0.99927	78	216.5
720	0.59062	224129	0.1400	0.99936	78	216.1
721	0.59066	224074	0.1405	0.99924	78	218.3
722	0.59078	223921	0.1410	0.99923	78	217.4
723	0.59138	223147	0.1415	0.99939	78	218.4
724	0.59141	223109	0.1420	0.99923	78	218.5
725	0.59130	223248	0.1425	0.99920	78	221.4
726	0.59139	223143	0.1431	0.99921	77	220.3
727	0.59212	222202	0.1436	0.99928	78	222.3
728	0.59188	222513	0.1441	0.99927	78	220.9
729	0.59255	221649	0.1446	0.99935	78	217.6
730	0.59251	221697	0.1450	0.99926	78	222.2
731	0.59254	221665	0.1456	0.99923	78	222.3
732	0.59269	221476	0.1462	0.99913	78	223.6
733	0.59329	220698	0.1468	0.99925	78	220.7
734	0.59333	220646	0.1473	0.99929	78	220.8
735	0.59363	220270	0.1478	0.99939	78	222.8
736	0.59381	220036	0.1483	0.99927	78	223.5
737	0.59389	219942	0.1488	0.99923	78	223.0
738	0.59400	219798	0.1494	0.99927	78	222.0
739	0.59423	219509	0.1499	0.99918	78	225.0
740	0.59458	219063	0.1504	0.99925	78	221.6
741	0.59483	218743	0.1509	0.99931	78	223.9
742	0.59489	218668	0.1515	0.99923	78	223.2
743	0.59504	218482	0.1520	0.99925	78	224.3
744	0.59512	218369	0.1526	0.99924	78	225.9
745	0.59540	218024	0.1532	0.99911	78	224.8
746	0.59575	217576	0.1538	0.99921	78	225.1
747	0.59602	217231	0.1543	0.99934	78	222.8
748	0.59635	216825	0.1549	0.99927	78	227.8
749	0.59670	216372	0.1555	0.99910	78	228.3
750	0.59706	215924	0.1562	0.99916	77	229.7
751	0.59741	215485	0.1568	0.99919	78	229.5
752	0.59756	215294	0.1574	0.99925	78	228.0
753	0.59780	214993	0.1580	0.99921	78	228.7
754	0.59806	214668	0.1586	0.99904	78	230.9
755	0.59817	214534	0.1593	0.99909	78	231.4
756	0.59850	214122	0.1600	0.99891	78	230.4
757	0.59872	213841	0.1609	0.99910	78	229.8
758	0.59897	213534	0.1615	0.99916	78	230.4
759	0.59929	213129	0.1623	0.99908	77	233.1
760	0.59999	212256	0.1630	0.99902	78	235.2
761	0.59991	212360	0.1639	0.99897	77	233.2
762	0.60019	212013	0.1647	0.99906	77	236.0
763	0.60066	211419	0.1656	0.99902	77	232.0
764	0.60074	211329	0.1665	0.99890	77	236.6
765	0.60128	210654	0.1674	0.99895	78	237.5
766	0.60166	210191	0.1683	0.99903	78	236.7

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
767	0.60219	209534	0.1691	0.99904	78	237.9
768	0.60253	209110	0.1699	0.99902	78	235.7
769	0.60224	209468	0.1708	0.99902	77	235.9
770	0.60296	208587	0.1717	0.99896	78	237.4
771	0.60300	208533	0.1726	0.99899	77	239.0
772	0.60339	208050	0.1735	0.99899	77	240.7
773	0.60376	207593	0.1745	0.99897	77	238.9
774	0.60417	207098	0.1754	0.99898	78	239.4
775	0.60447	206728	0.1763	0.99897	78	237.8
776	0.60489	206211	0.1774	0.99898	77	241.6

Table C19 Crack Growth rate Results - Specimen GPQ-11

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
121.8	61218	0.00025
123.8	61719	0.00024
123.8	61719	0.00019
125.9	62240	0.00018
126.5	62388	0.00022
135.5	64570	0.00027
136.1	64712	0.00042
136.2	64736	0.00017
135.8	64641	0.00018
140.2	65680	0.00018
146.1	67048	0.00016
150.5	68050	0.00021
152.7	68545	0.00022
154.3	68903	0.00022
159.3	70011	0.00022
160.7	70318	0.00025
167.2	71726	0.00028
167.5	71790	0.00030
167.0	71683	0.00040
174.7	73317	0.00028
176.8	73756	0.00036
178.1	74027	0.00030
187.6	75976	0.00033
192.8	77021	0.00034
188.0	76057	0.00035
199.8	78407	0.00033
205.0	79421	0.00036
202.8	78994	0.00043
213.6	81070	0.00039
219.7	82219	0.00056
219.9	82257	0.00080
230.1	84143	0.00113
230.5	84216	0.00353
213.6	81070	0.00016
234.2	84889	0.00165
232.9	84653	0.00185
235.6	85142	0.00168
238.9	85737	0.00289
246.5	87090	0.00224
246.2	87037	0.00234
250.9	87864	0.00307
251.8	88021	0.00265

Table C20 Crack Growth Rate Results - Specimen GPQ-23

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
121.3	61093	0.00020
120.0	60764	0.00018
123.7	61694	0.00017
126.5	62388	0.00015
128.5	62880	0.00012
125.5	62141	0.00004
128.9	62977	0.00005
130.2	63294	0.00007
128.7	62929	0.00009
130.5	63367	0.00010
132.3	63803	0.00007
136.0	64689	0.00009
136.6	64831	0.00018
138.6	65304	0.00022
142.4	66193	0.00022
147.8	67437	0.00019
148.3	67551	0.00013
150.0	67937	0.00013
156.2	69326	0.00015
160.7	70318	0.00014
160.6	70296	0.00013
163.7	70971	0.00014
169.0	72111	0.00015
171.2	72579	0.00016
176.5	73694	0.00014
181.4	74710	0.00013
186.5	75753	0.00014
188.9	76238	0.00015
191.6	76781	0.00014
192.0	76862	0.00015
201.4	78721	0.00015
203.5	79130	0.00015
209.1	80211	0.00015
213.6	81070	0.00016
218.4	81976	0.00018
225.0	83205	0.00018
229.7	84070	0.00021
236.0	85215	0.00026
240.7	86059	0.00030

Table C21 Tabulated Results for Cyclic J Specimen GPQ-25

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
1	0.48686	388091	0.0124	0.99353	20	110.2
2	0.48878	384420	0.0148	0.99768	34	111.6
3	0.48827	385384	0.0156	0.99743	35	114.7
4	0.49063	380918	0.0163	0.99822	37	116.6
5	0.49118	379879	0.0166	0.99914	37	113.9
6	0.49071	380762	0.0170	0.99880	38	115.9
7	0.49073	380735	0.0174	0.99856	39	115.4
8	0.49289	376676	0.0177	0.99942	39	116.1
9	0.49278	376882	0.0179	0.99955	38	115.3
10	0.49332	375871	0.0180	0.99960	39	114.6
11	0.49304	376390	0.0182	0.99951	39	116.9
12	0.49385	374887	0.0182	0.99971	39	114.8
13	0.49392	374744	0.0183	0.99972	39	113.6
14	0.49401	374586	0.0186	0.99941	40	118.7
15	0.49453	373626	0.0187	0.99952	40	116.6
16	0.49401	374581	0.0189	0.99958	40	115.3
17	0.49461	373475	0.0190	0.99964	41	118.0
18	0.49418	374265	0.0192	0.99957	41	119.0
19	0.49505	372649	0.0192	0.99971	41	117.5
20	0.49518	372418	0.0193	0.99971	41	116.6
21	0.49548	371850	0.0194	0.99975	41	114.8
22	0.49548	371848	0.0195	0.99968	42	118.8
23	0.49559	371658	0.0196	0.99974	41	114.1
24	0.49611	370684	0.0197	0.99973	42	116.9
25	0.49611	370693	0.0199	0.99962	42	121.4
26	0.49605	370807	0.0199	0.99969	42	116.6
27	0.49699	369061	0.0200	0.99973	43	120.4
28	0.49769	367784	0.0201	0.99979	43	119.5
29	0.49694	369166	0.0201	0.99974	43	116.4
30	0.49763	367892	0.0202	0.99974	43	116.7
31	0.49769	367778	0.0204	0.99972	44	121.4
32	0.49761	367922	0.0204	0.99975	43	119.6
33	0.49724	368610	0.0205	0.99973	44	118.0
34	0.49844	366400	0.0205	0.99980	44	116.4
35	0.49829	366675	0.0206	0.99977	44	120.1
36	0.49769	367785	0.0208	0.99965	44	121.0
37	0.49861	366097	0.0209	0.99970	45	122.8
38	0.49747	368184	0.0209	0.99975	44	119.6
39	0.49852	366263	0.0210	0.99976	44	120.7
40	0.49861	366093	0.0211	0.99975	45	118.9
41	0.49879	365771	0.0211	0.99975	44	118.5
42	0.49891	365555	0.0213	0.99969	45	122.3
43	0.49928	364881	0.0214	0.99971	45	118.3
44	0.49877	365806	0.0215	0.99970	45	122.3
45	0.49975	364010	0.0216	0.99973	45	123.5
46	0.49949	364488	0.0216	0.99977	45	117.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
47	0.49993	363694	0.0217	0.99976	45	122.3
48	0.49971	364088	0.0218	0.99968	45	120.3
49	0.50064	362392	0.0219	0.99967	45	123.0
50	0.50035	362926	0.0220	0.99970	46	124.8
51	0.50017	363260	0.0220	0.99974	45	120.9
52	0.50053	362598	0.0221	0.99979	45	118.3
53	0.50060	362464	0.0222	0.99979	45	120.7
54	0.50120	361382	0.0222	0.99978	46	123.1
55	0.50102	361704	0.0222	0.99981	45	120.1
56	0.50162	360618	0.0223	0.99981	45	120.7
57	0.50144	360949	0.0224	0.99976	46	123.1
58	0.50114	361501	0.0224	0.99976	46	118.9
59	0.50219	359597	0.0225	0.99973	46	124.4
60	0.50105	361653	0.0226	0.99969	46	124.1
61	0.50150	360836	0.0226	0.99978	46	122.8
62	0.50209	359768	0.0226	0.99984	46	122.6
63	0.50195	360026	0.0227	0.99978	46	122.6
64	0.50263	358796	0.0227	0.99980	46	123.2
65	0.50297	358197	0.0229	0.99977	46	121.8
66	0.50203	359888	0.0229	0.99976	46	122.6
67	0.50274	358604	0.0230	0.99978	46	120.4
68	0.50186	360185	0.0231	0.99967	46	122.2
69	0.50303	358079	0.0232	0.99972	47	127.0
70	0.50307	358003	0.0230	0.99979	46	121.8
71	0.50279	358521	0.0231	0.99978	46	122.1
72	0.50274	358599	0.0232	0.99979	46	122.0
73	0.50320	357774	0.0233	0.99972	47	125.6
74	0.50306	358026	0.0233	0.99971	47	121.3
75	0.50293	358269	0.0235	0.99967	47	125.7
76	0.50320	357767	0.0235	0.99970	47	126.0
77	0.50325	357683	0.0234	0.99980	46	119.6
78	0.50433	355748	0.0235	0.99976	47	125.5
79	0.50339	357442	0.0236	0.99969	47	123.3
80	0.50384	356623	0.0236	0.99979	47	119.3
81	0.50419	356005	0.0237	0.99979	47	124.7
82	0.50384	356620	0.0236	0.99982	46	119.8
83	0.50406	356232	0.0237	0.99977	47	121.3
84	0.50444	355547	0.0238	0.99978	47	124.1
85	0.50460	355265	0.0238	0.99980	47	124.4
86	0.50355	357149	0.0239	0.99977	47	124.3
87	0.50415	356065	0.0240	0.99977	47	124.7
88	0.50442	355597	0.0240	0.99978	47	123.3
89	0.50491	354709	0.0241	0.99981	47	120.8
90	0.50542	353804	0.0241	0.99983	47	124.0
91	0.50524	354131	0.0242	0.99977	48	125.6
92	0.50509	354401	0.0242	0.99978	47	122.7
93	0.50415	356066	0.0243	0.99971	48	124.9
94	0.50481	354886	0.0243	0.99979	47	123.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
95	0.50509	354392	0.0244	0.99976	47	124.9
96	0.50484	354837	0.0244	0.99978	47	122.2
97	0.50606	352661	0.0245	0.99980	48	123.2
98	0.50562	353444	0.0246	0.99972	48	127.3
99	0.50465	355173	0.0247	0.99966	48	127.3
100	0.50513	354329	0.0248	0.99970	48	126.9
101	0.50516	354271	0.0249	0.99968	48	126.6
102	0.50561	353472	0.0248	0.99979	47	124.3
103	0.50507	354422	0.0248	0.99979	47	120.7
104	0.50636	352135	0.0249	0.99981	48	126.0
105	0.50605	352674	0.0250	0.99971	48	126.0
106	0.50662	351668	0.0249	0.99983	47	120.0
107	0.50607	352653	0.0250	0.99979	47	124.2
108	0.50522	354162	0.0251	0.99972	48	125.5
109	0.50642	352028	0.0252	0.99977	48	126.0
110	0.50558	353521	0.0253	0.99972	48	124.7
111	0.50609	352607	0.0254	0.99972	48	127.6
112	0.50617	352470	0.0252	0.99979	47	124.4
113	0.50671	351519	0.0254	0.99978	48	124.9
114	0.50670	351526	0.0254	0.99978	48	124.6
115	0.50614	352525	0.0255	0.99972	48	123.2
116	0.50649	351905	0.0256	0.99964	49	127.1
117	0.50678	351385	0.0256	0.99972	48	124.9
118	0.50690	351172	0.0257	0.99971	48	122.8
119	0.50756	350011	0.0257	0.99975	48	123.0
120	0.50748	350144	0.0257	0.99977	48	124.3
121	0.50694	351112	0.0258	0.99978	48	121.8
122	0.50668	351565	0.0258	0.99971	48	127.2
123	0.50633	352184	0.0260	0.99955	49	128.2
124	0.50535	353921	0.0260	0.99942	49	125.4
125	0.50620	352415	0.0261	0.99963	48	122.7
126	0.50651	351869	0.0261	0.99966	48	126.1
127	0.50690	351175	0.0262	0.99965	49	128.3
128	0.50639	352085	0.0261	0.99971	48	122.0
129	0.50583	353079	0.0263	0.99944	49	128.7
130	0.50677	351410	0.0262	0.99971	48	121.5
131	0.50670	351522	0.0263	0.99970	49	126.3
132	0.50561	353457	0.0264	0.99962	48	126.4
133	0.50633	352181	0.0265	0.99959	49	127.6
134	0.50687	351232	0.0264	0.99970	48	125.3
135	0.50721	350619	0.0264	0.99974	48	125.7
136	0.50713	350761	0.0265	0.99972	49	127.0
137	0.50653	351825	0.0266	0.99969	48	126.2
138	0.50722	350614	0.0267	0.99968	49	126.4
139	0.50663	351659	0.0268	0.99962	49	128.9
140	0.50664	351631	0.0269	0.99962	49	125.9
141	0.50699	351020	0.0270	0.99967	49	124.9
142	0.50692	351137	0.0269	0.99970	49	120.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
143	0.50604	352700	0.0270	0.99968	48	125.7
144	0.50720	350644	0.0271	0.99970	49	124.8
145	0.50774	349690	0.0272	0.99975	49	124.9
146	0.50726	350528	0.0273	0.99968	49	129.9
147	0.50791	349397	0.0274	0.99967	49	128.0
148	0.50868	348030	0.0274	0.99977	49	125.6
149	0.50833	348655	0.0274	0.99973	49	126.0
150	0.50861	348153	0.0276	0.99971	49	130.7
151	0.50936	346837	0.0275	0.99982	49	126.1
152	0.50861	348151	0.0276	0.99977	49	128.7
153	0.50915	347208	0.0276	0.99981	48	126.2
154	0.50996	345788	0.0277	0.99984	49	125.1
155	0.50955	346501	0.0277	0.99979	49	124.2
156	0.50853	348288	0.0279	0.99971	49	130.9
157	0.50936	346832	0.0278	0.99980	49	123.8
158	0.50998	345750	0.0280	0.99982	49	130.9
159	0.50960	346415	0.0279	0.99982	49	125.4
160	0.50989	345900	0.0280	0.99983	48	124.6
161	0.51002	345682	0.0281	0.99983	49	128.9
162	0.50968	346278	0.0282	0.99980	49	129.2
163	0.51011	345527	0.0282	0.99979	49	130.6
164	0.51080	344309	0.0282	0.99983	49	124.7
165	0.51092	344105	0.0282	0.99984	49	128.3
166	0.51063	344609	0.0284	0.99983	49	130.9
167	0.51084	344255	0.0285	0.99979	49	128.9
168	0.51139	343280	0.0285	0.99982	49	130.8
169	0.51157	342975	0.0286	0.99982	50	131.2
170	0.51168	342791	0.0287	0.99978	49	131.4
171	0.51193	342349	0.0287	0.99987	49	129.5
172	0.51220	341876	0.0288	0.99985	49	131.1
173	0.51192	342359	0.0288	0.99982	49	131.1
174	0.51168	342791	0.0289	0.99983	49	130.5
175	0.51238	341569	0.0290	0.99983	49	131.2
176	0.51271	341001	0.0291	0.99979	49	131.3
177	0.51314	340251	0.0292	0.99977	50	130.3
178	0.51219	341894	0.0291	0.99984	48	125.0
179	0.51339	339828	0.0292	0.99982	49	131.4
180	0.51317	340195	0.0294	0.99977	50	131.7
181	0.51326	340047	0.0294	0.99983	49	130.8
182	0.51321	340127	0.0295	0.99976	49	130.4
183	0.51353	339584	0.0296	0.99977	50	129.9
184	0.51353	339584	0.0297	0.99971	49	129.9
185	0.51370	339288	0.0298	0.99968	50	135.3
186	0.51363	339406	0.0297	0.99974	49	129.1
187	0.51455	337823	0.0298	0.99980	49	131.3
188	0.51476	337464	0.0299	0.99982	50	130.8
189	0.51483	337344	0.0299	0.99980	50	132.9
190	0.51469	337577	0.0299	0.99983	49	131.4

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Corre- lation	Number of Data	J Range (in-lb/in ²)
191	0.51479	337404	0.0300	0.99984	49	130.6
192	0.51546	336261	0.0301	0.99982	50	133.0
193	0.51542	336331	0.0301	0.99981	49	131.2
194	0.51595	335419	0.0302	0.99981	50	130.2
195	0.51518	336729	0.0303	0.99978	49	130.4
196	0.51492	337189	0.0304	0.99971	50	134.9
197	0.51546	336255	0.0305	0.99959	50	136.8
198	0.51615	335074	0.0306	0.99972	49	131.1
199	0.51605	335240	0.0307	0.99970	50	135.7
200	0.51642	334616	0.0306	0.99983	49	129.7
201	0.51694	333723	0.0306	0.99981	49	131.8
202	0.51637	334703	0.0308	0.99974	50	130.3
203	0.51601	335320	0.0309	0.99966	50	135.9
204	0.51616	335065	0.0310	0.99968	49	130.9
205	0.51649	334487	0.0311	0.99968	50	137.0
206	0.51690	333794	0.0312	0.99961	50	137.0
207	0.51705	333534	0.0313	0.99965	50	137.0
208	0.51759	332624	0.0312	0.99976	49	132.6
209	0.51737	332998	0.0313	0.99972	50	131.3
210	0.51713	333411	0.0314	0.99971	49	131.0
211	0.51791	332080	0.0315	0.99967	50	137.5
212	0.51809	331765	0.0314	0.99978	49	132.5
213	0.51791	332076	0.0315	0.99978	49	131.9
214	0.51804	331849	0.0316	0.99966	50	131.5
215	0.51758	332644	0.0318	0.99963	50	135.7
216	0.51732	333075	0.0318	0.99968	49	136.1
217	0.51748	332808	0.0320	0.99963	50	137.2
218	0.51729	333134	0.0320	0.99959	50	133.9
219	0.51771	332412	0.0321	0.99967	49	136.1
220	0.51811	331730	0.0322	0.99971	50	136.9
221	0.51808	331784	0.0322	0.99968	50	136.7
222	0.51790	332097	0.0324	0.99961	50	137.0
223	0.51794	332018	0.0325	0.99962	50	136.8
224	0.51838	331280	0.0326	0.99967	50	137.4
225	0.51839	331268	0.0327	0.99965	50	137.8
226	0.51769	332457	0.0328	0.99966	50	136.3
227	0.51822	331555	0.0328	0.99972	50	136.5
228	0.51795	332001	0.0329	0.99972	48	131.7
229	0.51825	331497	0.0330	0.99970	50	137.1
230	0.51868	330778	0.0331	0.99967	50	134.2
231	0.51857	330959	0.0332	0.99967	50	136.6
232	0.51805	331844	0.0333	0.99965	50	136.3
233	0.51823	331530	0.0334	0.99960	50	135.7
234	0.51900	330233	0.0335	0.99973	50	137.2
235	0.51834	331338	0.0336	0.99953	50	136.6
236	0.51811	331731	0.0337	0.99961	50	136.3
237	0.51826	331474	0.0338	0.99964	50	138.2
238	0.51876	330627	0.0340	0.99964	50	136.4

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
239	0.51826	331481	0.0340	0.99965	50	135.6
240	0.51864	330841	0.0342	0.99961	50	135.3
241	0.51917	329936	0.0342	0.99972	50	135.4
242	0.51905	330144	0.0344	0.99965	50	135.9
243	0.51894	330323	0.0345	0.99960	50	135.1
244	0.51953	329332	0.0345	0.99978	49	135.3
245	0.51937	329604	0.0346	0.99970	50	136.7
246	0.51885	330479	0.0347	0.99969	50	136.0
247	0.51868	330771	0.0347	0.99970	50	136.0
248	0.51879	330592	0.0346	0.99977	49	134.6
249	0.52050	327691	0.0348	0.99979	50	135.6
250	0.52043	327820	0.0348	0.99977	49	136.3
251	0.52038	327901	0.0350	0.99962	50	138.2
252	0.52072	327326	0.0351	0.99970	50	140.0
253	0.52016	328275	0.0352	0.99966	50	137.2
254	0.52108	326723	0.0353	0.99969	50	136.8
255	0.52050	327699	0.0354	0.99969	50	140.0
256	0.52173	325643	0.0355	0.99973	50	137.1
257	0.52106	326758	0.0356	0.99965	50	136.0
258	0.52142	326163	0.0357	0.99970	50	141.2
259	0.52173	325635	0.0358	0.99971	50	139.0
260	0.52173	325631	0.0359	0.99970	50	141.3
261	0.52179	325538	0.0360	0.99967	50	142.3
262	0.52181	325506	0.0361	0.99973	50	139.7
263	0.52249	324357	0.0361	0.99977	50	136.4
264	0.52218	324886	0.0362	0.99975	50	135.3
265	0.52223	324799	0.0364	0.99967	50	141.6
266	0.52204	325113	0.0365	0.99962	50	142.6
267	0.52307	323403	0.0364	0.99981	49	137.5
268	0.52317	323231	0.0365	0.99976	50	136.3
269	0.52316	323252	0.0366	0.99978	50	136.6
270	0.52372	322311	0.0367	0.99977	50	137.1
271	0.52341	322840	0.0368	0.99975	50	141.4
272	0.52362	322476	0.0368	0.99975	50	136.9
273	0.52262	324148	0.0370	0.99963	50	142.4
274	0.52323	323131	0.0371	0.99966	50	143.1
275	0.52397	321904	0.0372	0.99973	50	142.2
276	0.52265	324103	0.0373	0.99969	50	137.2
277	0.52303	323464	0.0373	0.99972	50	142.0
278	0.52241	324505	0.0375	0.99957	50	143.1
279	0.52306	323416	0.0375	0.99968	50	137.6
280	0.52350	322686	0.0375	0.99978	50	136.8
281	0.52282	323817	0.0376	0.99968	50	140.6
282	0.52531	319689	0.0377	0.99974	50	138.5
283	0.52562	319173	0.0378	0.99970	50	137.5
284	0.52497	320252	0.0379	0.99972	50	143.0
285	0.52527	319744	0.0380	0.99973	50	137.6
286	0.52540	319531	0.0381	0.99971	50	143.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
287	0.52549	319395	0.0383	0.99966	50	144.1
288	0.52588	318736	0.0382	0.99976	50	141.5
289	0.52535	319618	0.0385	0.99954	50	145.3
290	0.52567	319091	0.0386	0.99962	50	145.1
291	0.52611	318364	0.0387	0.99966	50	144.4
292	0.52586	318773	0.0388	0.99963	50	144.2
293	0.52628	318081	0.0389	0.99966	50	144.2
294	0.52634	317983	0.0390	0.99969	50	144.0
295	0.52706	316804	0.0389	0.99978	50	139.7
296	0.52623	318161	0.0391	0.99964	50	144.4
297	0.52698	316936	0.0392	0.99971	50	144.6
298	0.52669	317410	0.0394	0.99966	50	144.6
299	0.52689	317084	0.0395	0.99966	50	144.6
300	0.52751	316069	0.0395	0.99972	50	144.4
301	0.52746	316141	0.0396	0.99970	50	145.0
302	0.52720	316581	0.0397	0.99972	50	144.4
303	0.52759	315937	0.0399	0.99957	51	146.3
304	0.52827	314819	0.0400	0.99975	50	144.9
305	0.52794	315357	0.0401	0.99968	50	144.9
306	0.52794	315360	0.0402	0.99965	51	144.5
307	0.52800	315257	0.0404	0.99961	51	144.7
308	0.52849	314465	0.0404	0.99964	51	140.6
309	0.52826	314848	0.0406	0.99967	50	145.4
310	0.52755	316008	0.0407	0.99964	50	144.8
311	0.52817	314987	0.0408	0.99963	51	145.6
312	0.52812	315062	0.0409	0.99967	50	145.3
313	0.52894	313729	0.0409	0.99974	50	139.7
314	0.52927	313200	0.0409	0.99978	50	138.3
315	0.52991	312150	0.0410	0.99977	50	145.0
316	0.53004	311944	0.0411	0.99974	50	145.0
317	0.52899	313655	0.0413	0.99964	50	146.3
318	0.52904	313565	0.0413	0.99966	50	145.2
319	0.52885	313880	0.0415	0.99960	50	144.6
320	0.52922	313275	0.0415	0.99965	50	144.7
321	0.52966	312566	0.0417	0.99961	50	146.1
322	0.52996	312068	0.0418	0.99958	50	147.0
323	0.52994	312100	0.0419	0.99971	50	145.3
324	0.53037	311408	0.0419	0.99975	50	144.5
325	0.53006	311919	0.0422	0.99961	50	145.7
326	0.53067	310920	0.0423	0.99962	50	145.0
327	0.53069	310884	0.0424	0.99961	51	145.3
328	0.53118	310093	0.0425	0.99965	51	145.2
329	0.53130	309903	0.0426	0.99967	50	145.8
330	0.53111	310218	0.0427	0.99963	50	145.8
331	0.53132	309880	0.0428	0.99968	50	145.1
332	0.53108	310267	0.0430	0.99958	51	145.5
333	0.53152	309552	0.0430	0.99970	50	145.0
334	0.53100	310387	0.0433	0.99955	50	151.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
335	0.53055	311111	0.0434	0.99954	50	145.0
336	0.53230	308293	0.0435	0.99967	51	145.4
337	0.53233	308253	0.0435	0.99967	51	143.9
338	0.53196	308846	0.0436	0.99973	50	144.8
339	0.53193	308898	0.0438	0.99960	51	151.1
340	0.53163	309378	0.0440	0.99957	51	151.1
341	0.53158	309448	0.0441	0.99961	51	146.3
342	0.53214	308554	0.0442	0.99972	50	146.7
343	0.53183	309044	0.0442	0.99969	50	145.7
344	0.53186	308999	0.0443	0.99967	50	146.2
345	0.53186	309001	0.0444	0.99968	50	145.3
346	0.53214	308545	0.0446	0.99954	51	151.4
347	0.53247	308027	0.0447	0.99964	50	146.5
348	0.53263	307767	0.0448	0.99967	50	146.0
349	0.53314	306946	0.0449	0.99971	51	145.7
350	0.53311	306987	0.0449	0.99964	51	149.1
351	0.53302	307143	0.0451	0.99968	50	146.7
352	0.53345	306447	0.0452	0.99968	50	145.2
353	0.53353	306328	0.0453	0.99965	50	145.7
354	0.53382	305857	0.0455	0.99959	51	152.8
355	0.53328	306715	0.0455	0.99965	50	146.9
356	0.53384	305826	0.0456	0.99970	50	145.8
357	0.53412	305379	0.0457	0.99972	50	145.2
358	0.53434	305021	0.0458	0.99966	51	146.9
359	0.53472	304422	0.0459	0.99970	50	147.1
360	0.53450	304776	0.0460	0.99971	50	146.1
361	0.53510	303811	0.0462	0.99965	50	153.1
362	0.53400	305577	0.0463	0.99953	50	152.6
363	0.53480	304286	0.0464	0.99957	51	146.9
364	0.53490	304132	0.0465	0.99958	51	151.5
365	0.53551	303172	0.0466	0.99968	50	147.5
366	0.53590	302549	0.0467	0.99969	50	147.0
367	0.53611	302212	0.0468	0.99968	50	147.0
368	0.53625	301989	0.0470	0.99953	51	153.6
369	0.53672	301249	0.0471	0.99970	50	148.6
370	0.53566	302925	0.0474	0.99934	50	155.5
371	0.53614	302168	0.0475	0.99956	50	154.1
372	0.53636	301809	0.0476	0.99958	51	153.4
373	0.53679	301130	0.0478	0.99960	51	153.8
374	0.53678	301154	0.0478	0.99965	50	147.2
375	0.53662	301406	0.0480	0.99959	50	154.3
376	0.53669	301291	0.0482	0.99953	50	154.6
377	0.53713	300598	0.0483	0.99967	50	153.5
378	0.53715	300575	0.0484	0.99962	51	153.4
379	0.53795	299299	0.0485	0.99966	51	152.1
380	0.53771	299685	0.0486	0.99968	50	147.0
381	0.53741	300150	0.0487	0.99965	50	152.1
382	0.53758	299891	0.0488	0.99965	50	152.8

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
383	0.53806	299135	0.0490	0.99954	51	155.0
384	0.53839	298611	0.0491	0.99962	51	150.4
385	0.53705	300731	0.0492	0.99956	50	152.0
386	0.53848	298473	0.0494	0.99966	50	153.9
387	0.53856	298344	0.0495	0.99965	50	154.2
388	0.53848	298468	0.0496	0.99968	50	153.2
389	0.53877	298017	0.0497	0.99966	50	154.0
390	0.53913	297448	0.0498	0.99962	51	153.6
391	0.53881	297947	0.0499	0.99969	48	153.4
392	0.53878	298002	0.0501	0.99962	50	153.9
393	0.53866	298189	0.0502	0.99959	50	155.0
394	0.53952	296847	0.0503	0.99966	51	154.9
395	0.53966	296626	0.0505	0.99965	51	155.1
396	0.53778	299572	0.0508	0.99908	51	152.5
397	0.53949	296891	0.0509	0.99960	50	155.4
398	0.53913	297453	0.0512	0.99944	50	157.7
399	0.53869	298151	0.0514	0.99941	50	157.0
400	0.54000	296097	0.0515	0.99961	51	155.5
401	0.54081	294822	0.0516	0.99964	51	156.1
402	0.54023	295734	0.0517	0.99960	51	151.6
403	0.54064	295091	0.0520	0.99959	51	155.3
404	0.54002	296056	0.0521	0.99952	50	156.6
405	0.54107	294430	0.0522	0.99969	50	151.7
406	0.54081	294824	0.0524	0.99957	51	155.7
407	0.54099	294548	0.0525	0.99964	51	155.6
408	0.54065	295073	0.0526	0.99962	51	150.5
409	0.54034	295567	0.0529	0.99937	51	156.7
410	0.54073	294958	0.0531	0.99953	50	155.8
411	0.54101	294524	0.0532	0.99961	51	155.9
412	0.54087	294743	0.0535	0.99940	51	159.3
413	0.54014	295869	0.0537	0.99922	51	155.9
414	0.54150	293761	0.0538	0.99963	50	156.4
415	0.54131	294056	0.0540	0.99954	50	156.9
416	0.54197	293024	0.0542	0.99958	51	155.7
417	0.54141	293894	0.0543	0.99962	50	155.4
418	0.54238	292390	0.0544	0.99969	51	155.7
419	0.54264	291991	0.0545	0.99968	51	155.5
420	0.54214	292770	0.0547	0.99951	51	155.6
421	0.54182	293256	0.0550	0.99935	51	157.5
422	0.54205	292909	0.0550	0.99953	50	156.7
423	0.54218	292703	0.0552	0.99960	50	156.4
424	0.54302	291404	0.0553	0.99968	51	156.0
425	0.54260	292050	0.0554	0.99963	51	156.0
426	0.54273	291852	0.0555	0.99963	51	155.9
427	0.54313	291236	0.0556	0.99965	50	156.6
428	0.54338	290845	0.0559	0.99955	51	156.6
429	0.54302	291402	0.0560	0.99958	50	156.7
430	0.54351	290651	0.0561	0.99963	51	157.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
431	0.54347	290711	0.0562	0.99962	51	156.5
432	0.54337	290855	0.0562	0.99960	51	152.3
433	0.54336	290880	0.0564	0.99963	50	156.5
434	0.54376	290257	0.0566	0.99966	50	156.4
435	0.54389	290061	0.0567	0.99961	51	156.6
436	0.54441	289265	0.0568	0.99963	51	156.4
437	0.54415	289666	0.0570	0.99958	51	157.5
438	0.54335	290887	0.0571	0.99942	51	154.7
439	0.54342	290786	0.0574	0.99907	51	163.1
440	0.54444	289213	0.0575	0.99961	50	158.3
441	0.54516	288110	0.0578	0.99958	51	157.8
442	0.54547	287630	0.0579	0.99958	51	158.4
443	0.54489	288530	0.0581	0.99957	50	157.7
444	0.54504	288290	0.0582	0.99963	50	157.0
445	0.54617	286574	0.0583	0.99967	51	157.7
446	0.54617	286572	0.0584	0.99969	51	157.2
447	0.54607	286717	0.0585	0.99965	51	156.7
448	0.54570	287291	0.0589	0.99941	51	165.7
449	0.54575	287206	0.0589	0.99956	50	159.2
450	0.54657	285958	0.0591	0.99961	50	158.7
451	0.54627	286421	0.0592	0.99963	50	157.1
452	0.54700	285308	0.0593	0.99967	51	157.7
453	0.54656	285968	0.0594	0.99961	51	156.9
454	0.54639	286234	0.0596	0.99960	51	156.9
455	0.54572	287250	0.0599	0.99908	51	164.8
456	0.54669	285772	0.0601	0.99943	51	158.7
457	0.54651	286053	0.0603	0.99955	50	157.3
458	0.54682	285571	0.0604	0.99956	50	158.0
459	0.54708	285183	0.0605	0.99961	50	157.7
460	0.54731	284832	0.0606	0.99964	51	157.8
461	0.54746	284609	0.0607	0.99963	51	158.3
462	0.54704	285236	0.0609	0.99958	51	157.6
463	0.54619	286532	0.0613	0.99896	51	167.9
464	0.54721	284990	0.0614	0.99944	50	158.8
465	0.54737	284743	0.0616	0.99957	50	158.0
466	0.54784	284026	0.0617	0.99962	50	157.0
467	0.54800	283790	0.0618	0.99962	50	157.7
468	0.54789	283950	0.0619	0.99954	51	157.8
469	0.54814	283567	0.0621	0.99960	51	163.2
470	0.54644	286150	0.0624	0.99888	51	166.1
471	0.54758	284426	0.0626	0.99950	50	164.1
472	0.54708	285177	0.0628	0.99940	50	158.5
473	0.54763	284345	0.0632	0.99925	51	167.0
474	0.54787	283985	0.0633	0.99957	50	164.0
475	0.54844	283116	0.0634	0.99964	50	158.4
476	0.54780	284082	0.0638	0.99936	51	166.8
477	0.54906	282181	0.0639	0.99962	51	165.0
478	0.54872	282701	0.0641	0.99954	51	166.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
479	0.54875	282645	0.0642	0.99955	51	158.8
480	0.54874	282665	0.0644	0.99942	51	165.9
481	0.54827	283370	0.0647	0.99923	51	168.1
482	0.54828	283358	0.0650	0.99926	50	167.6
483	0.54845	283099	0.0650	0.99956	50	163.5
484	0.54903	282225	0.0652	0.99959	50	164.5
485	0.54915	282044	0.0654	0.99947	50	166.8
486	0.54875	282652	0.0657	0.99924	51	168.2
487	0.54986	280969	0.0658	0.99954	50	165.3
488	0.54868	282759	0.0662	0.99911	51	168.7
489	0.54945	281598	0.0663	0.99953	51	165.5
490	0.54985	280990	0.0664	0.99958	51	165.4
491	0.55014	280551	0.0665	0.99962	51	165.5
492	0.54909	282139	0.0669	0.99915	51	168.7
493	0.54945	281593	0.0672	0.99927	51	169.1
494	0.54898	282301	0.0675	0.99885	51	168.0
495	0.54918	282003	0.0679	0.99893	51	167.8
496	0.54976	281121	0.0683	0.99892	51	168.2
497	0.55016	280518	0.0688	0.99913	51	171.3
498	0.55096	279326	0.0690	0.99944	51	168.8
499	0.55168	278253	0.0691	0.99951	51	167.7
500	0.55144	278605	0.0694	0.99945	51	169.0
501	0.55095	279346	0.0697	0.99917	51	169.1
502	0.55205	277688	0.0698	0.99954	51	167.3
503	0.55091	279405	0.0701	0.99910	51	168.2
504	0.55203	277729	0.0703	0.99946	51	167.4
505	0.55111	279098	0.0706	0.99912	51	168.4
506	0.55240	277167	0.0708	0.99955	51	167.4
507	0.55242	277147	0.0710	0.99952	51	168.0
508	0.55163	278315	0.0713	0.99916	51	170.5
509	0.55205	277692	0.0717	0.99919	51	168.9
510	0.55298	276314	0.0718	0.99957	51	168.0
511	0.55301	276268	0.0720	0.99955	51	167.5
512	0.55205	277701	0.0723	0.99917	51	169.0
513	0.55346	275595	0.0724	0.99951	51	167.5
514	0.55235	277244	0.0728	0.99901	51	170.7
515	0.55282	276549	0.0731	0.99932	51	171.3
516	0.55318	276017	0.0734	0.99939	51	171.3
517	0.55337	275726	0.0737	0.99938	51	169.4
518	0.55351	275520	0.0739	0.99941	51	169.4
519	0.55341	275673	0.0741	0.99948	51	167.8
520	0.55411	274626	0.0742	0.99958	50	168.8
521	0.55336	275750	0.0746	0.99913	51	170.3
522	0.55394	274891	0.0748	0.99937	51	170.0
523	0.55394	274882	0.0751	0.99923	51	169.5
524	0.55504	273259	0.0752	0.99954	51	168.4
525	0.55400	274799	0.0756	0.99912	51	169.8
526	0.55468	273790	0.0758	0.99950	51	167.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
527	0.55406	274700	0.0762	0.99903	51	169.5
528	0.55534	272817	0.0763	0.99950	51	167.9
529	0.55513	273123	0.0765	0.99935	51	170.6
530	0.55503	273273	0.0769	0.99924	51	169.5
531	0.55568	272313	0.0770	0.99949	51	167.9
532	0.55499	273331	0.0774	0.99900	51	177.0
533	0.55626	271461	0.0776	0.99952	51	169.4
534	0.55549	272598	0.0779	0.99920	51	176.1
535	0.55613	271648	0.0781	0.99944	51	168.8
536	0.55662	270935	0.0782	0.99953	51	169.2
537	0.55584	272079	0.0786	0.99922	51	176.1
538	0.55649	271126	0.0788	0.99945	51	170.5
539	0.55630	271402	0.0791	0.99918	51	177.4
540	0.55729	269948	0.0792	0.99955	51	169.6
541	0.55645	271189	0.0796	0.99912	51	177.6
542	0.55752	269615	0.0798	0.99950	51	169.2
543	0.55656	271023	0.0801	0.99911	51	178.0
544	0.55745	269721	0.0804	0.99940	51	171.3
545	0.55679	270682	0.0807	0.99916	51	177.4
546	0.55712	270205	0.0811	0.99897	51	179.6
547	0.55740	269787	0.0815	0.99904	51	174.0
548	0.55794	269006	0.0818	0.99923	51	178.4
549	0.55868	267923	0.0820	0.99950	51	170.1
550	0.55805	268844	0.0823	0.99922	51	178.8
551	0.55872	267859	0.0826	0.99930	51	173.4
552	0.55847	268224	0.0828	0.99926	51	178.5
553	0.55852	268155	0.0832	0.99914	51	180.2
554	0.55866	267955	0.0836	0.99912	51	179.9
555	0.55887	267645	0.0839	0.99910	51	180.6
556	0.55896	267520	0.0843	0.99909	51	180.2
557	0.56016	265776	0.0844	0.99948	51	171.4
558	0.56019	265729	0.0847	0.99941	51	172.6
559	0.55962	266551	0.0850	0.99925	51	179.5
560	0.55957	266625	0.0854	0.99909	51	181.1
561	0.55986	266203	0.0857	0.99914	51	181.0
562	0.55995	266080	0.0861	0.99900	51	181.8
563	0.56086	264762	0.0863	0.99939	51	180.3
564	0.56077	264888	0.0866	0.99945	50	174.8
565	0.56049	265293	0.0870	0.99915	51	175.8
566	0.56014	265804	0.0872	0.99899	51	179.7
567	0.56070	264991	0.0877	0.99908	51	181.1
568	0.56121	264259	0.0879	0.99945	51	178.5
569	0.56008	265890	0.0883	0.99885	51	179.3
570	0.56210	262974	0.0884	0.99945	51	178.8
571	0.56123	264223	0.0887	0.99924	51	180.9
572	0.56130	264134	0.0892	0.99897	51	182.6
573	0.56259	262276	0.0894	0.99943	51	180.8
574	0.56234	262638	0.0898	0.99921	51	183.0

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
575	0.56215	262908	0.0901	0.99916	51	181.7
576	0.56283	261924	0.0905	0.99905	51	183.3
577	0.56251	262392	0.0909	0.99898	51	183.4
578	0.56319	261412	0.0913	0.99906	51	183.9
579	0.56405	260179	0.0914	0.99946	51	180.8
580	0.56379	260556	0.0916	0.99941	51	182.0
581	0.56366	260740	0.0920	0.99927	51	182.1
582	0.56293	261791	0.0923	0.99899	51	183.3
583	0.56433	259782	0.0925	0.99947	51	181.8
584	0.56372	260651	0.0928	0.99911	51	184.0
585	0.56411	260099	0.0932	0.99906	51	182.7
586	0.56368	260712	0.0937	0.99890	51	183.1
587	0.56496	258897	0.0939	0.99927	51	183.9
588	0.56447	259589	0.0943	0.99924	51	182.7
589	0.56488	259006	0.0945	0.99932	51	184.6
590	0.56502	258807	0.0948	0.99930	51	179.9
591	0.56408	260138	0.0952	0.99885	51	181.6
592	0.56465	259335	0.0957	0.99896	51	184.4
593	0.56413	260073	0.0961	0.99889	51	182.8
594	0.56477	259160	0.0965	0.99901	51	184.0
595	0.56549	258132	0.0967	0.99946	51	183.1
596	0.56608	257296	0.0970	0.99931	51	183.5
597	0.56594	257497	0.0974	0.99914	51	183.7
598	0.56546	258183	0.0978	0.99905	51	184.2
599	0.56608	257301	0.0981	0.99912	51	184.2
600	0.56611	257254	0.0985	0.99903	51	185.3
601	0.56648	256735	0.0989	0.99907	51	185.1
602	0.56737	255478	0.0991	0.99946	51	183.5
603	0.56678	256313	0.0995	0.99927	51	182.8
604	0.56647	256753	0.0999	0.99905	51	184.7
605	0.56721	255703	0.1001	0.99939	51	183.1
606	0.56822	254290	0.1003	0.99952	51	185.9
607	0.56708	255884	0.1005	0.99932	51	181.1
608	0.56727	255621	0.1010	0.99915	51	190.9
609	0.56667	256463	0.1014	0.99891	51	186.6
610	0.56784	254818	0.1017	0.99935	51	184.9
611	0.56757	255193	0.1021	0.99913	51	191.0
612	0.56813	254410	0.1025	0.99905	51	193.5
613	0.56796	254654	0.1028	0.99905	51	193.1
614	0.56872	253581	0.1032	0.99914	51	193.1
615	0.56834	254120	0.1036	0.99900	51	186.8
616	0.56902	253164	0.1040	0.99919	51	192.7
617	0.56941	252612	0.1043	0.99929	51	187.5
618	0.56879	253481	0.1046	0.99915	51	189.2
619	0.56925	252840	0.1049	0.99932	51	191.5
620	0.56916	252972	0.1053	0.99904	51	194.7
621	0.56914	252991	0.1057	0.99911	51	193.2
622	0.57034	251326	0.1061	0.99917	52	194.7

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
623	0.56945	252562	0.1065	0.99905	51	194.1
624	0.57011	251640	0.1069	0.99915	51	194.9
625	0.57034	251321	0.1070	0.99943	51	184.9
626	0.57039	251249	0.1074	0.99932	51	192.8
627	0.57025	251445	0.1078	0.99903	51	194.7
628	0.57039	251255	0.1082	0.99907	51	195.0
629	0.57164	249510	0.1084	0.99939	51	188.5
630	0.56979	252090	0.1089	0.99860	51	194.4
631	0.57184	249241	0.1094	0.99910	52	197.1
632	0.57202	248986	0.1096	0.99945	51	192.8
633	0.57182	249271	0.1101	0.99897	52	197.3
634	0.57201	249004	0.1104	0.99920	52	195.8
635	0.57160	249572	0.1108	0.99913	51	195.3
636	0.57236	248511	0.1112	0.99917	51	196.3
637	0.57234	248539	0.1115	0.99924	51	195.7
638	0.57227	248636	0.1119	0.99916	51	196.7
639	0.57245	248395	0.1123	0.99928	51	195.7
640	0.57322	247334	0.1125	0.99941	51	191.0
641	0.57344	247033	0.1127	0.99948	51	192.2
642	0.57343	247036	0.1130	0.99909	52	194.0
643	0.57361	246797	0.1133	0.99946	51	193.5
644	0.57379	246542	0.1136	0.99925	52	195.7
645	0.57352	246923	0.1140	0.99911	51	196.9
646	0.57343	247043	0.1144	0.99915	51	196.7
647	0.57382	246505	0.1147	0.99917	51	196.6
648	0.57452	245544	0.1150	0.99942	51	196.5
649	0.57433	245808	0.1153	0.99928	51	194.4
650	0.57511	244742	0.1155	0.99946	51	197.3
651	0.57496	244941	0.1158	0.99934	52	195.5
652	0.57483	245121	0.1163	0.99909	52	197.6
653	0.57423	245949	0.1167	0.99898	51	196.7
654	0.57452	245537	0.1170	0.99907	51	197.3
655	0.57523	244575	0.1174	0.99919	51	197.7
656	0.57487	245068	0.1179	0.99900	51	199.6
657	0.57601	243505	0.1181	0.99924	52	195.8
658	0.57621	243236	0.1186	0.99920	52	196.5
659	0.57638	242998	0.1189	0.99933	52	199.8
660	0.57617	243292	0.1192	0.99939	51	195.3
661	0.57588	243686	0.1195	0.99909	51	197.3
662	0.57622	243226	0.1199	0.99929	51	197.8
663	0.57692	242269	0.1203	0.99917	51	199.7
664	0.57664	242649	0.1207	0.99902	51	202.6
665	0.57828	240421	0.1210	0.99937	52	199.2
666	0.57793	240903	0.1214	0.99916	52	200.3
667	0.57758	241371	0.1217	0.99928	51	197.8
668	0.57800	240799	0.1221	0.99914	51	201.0
669	0.57806	240728	0.1225	0.99920	51	199.4
670	0.57870	239857	0.1227	0.99938	51	202.8

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
671	0.57911	239307	0.1231	0.99931	52	201.4
672	0.57873	239811	0.1234	0.99922	52	198.3
673	0.57907	239362	0.1238	0.99909	52	207.8
674	0.57898	239483	0.1242	0.99904	51	202.2
675	0.57885	239661	0.1246	0.99909	51	200.3
676	0.57913	239277	0.1250	0.99889	51	204.5
677	0.57987	238286	0.1254	0.99926	52	201.3
678	0.57975	238440	0.1257	0.99926	52	207.1
679	0.58024	237787	0.1260	0.99938	51	201.7
680	0.57998	238136	0.1263	0.99939	51	198.8
681	0.57970	238517	0.1266	0.99918	51	207.6
682	0.58020	237842	0.1269	0.99936	51	201.2
683	0.58074	237122	0.1272	0.99941	52	199.8
684	0.58078	237066	0.1275	0.99930	52	207.7
685	0.58001	238089	0.1280	0.99909	51	200.9
686	0.58073	237125	0.1284	0.99920	51	208.5
687	0.58005	238041	0.1288	0.99880	51	211.0
688	0.57984	238323	0.1293	0.99856	51	203.9
689	0.58132	236343	0.1298	0.99925	51	202.0
690	0.58168	235863	0.1302	0.99928	51	208.5
691	0.58154	236048	0.1306	0.99919	51	209.5
692	0.58173	235797	0.1309	0.99914	51	209.8
693	0.58132	236339	0.1314	0.99881	51	208.9
694	0.58188	235593	0.1320	0.99891	52	205.2
695	0.58239	234907	0.1324	0.99910	51	211.5
696	0.58272	234477	0.1328	0.99916	51	210.9
697	0.58255	234700	0.1332	0.99890	51	206.9
698	0.58343	233538	0.1336	0.99935	52	209.6
699	0.58338	233595	0.1340	0.99918	52	212.0
700	0.58312	233941	0.1344	0.99911	51	211.4
701	0.58364	233255	0.1347	0.99918	51	212.5
702	0.58367	233217	0.1351	0.99903	52	211.6
703	0.58440	232253	0.1355	0.99928	52	212.0
704	0.58386	232965	0.1359	0.99934	51	210.2
705	0.58422	232480	0.1362	0.99925	51	211.4
706	0.58381	233026	0.1366	0.99917	51	211.5
707	0.58420	232515	0.1371	0.99857	52	216.4
708	0.58522	231163	0.1376	0.99933	52	213.4
709	0.58525	231132	0.1379	0.99936	51	211.4
710	0.58480	231723	0.1384	0.99893	51	217.2
711	0.58507	231360	0.1389	0.99879	52	213.6
712	0.58595	230205	0.1394	0.99920	52	214.1
713	0.58558	230699	0.1398	0.99924	51	212.7
714	0.58579	230412	0.1401	0.99924	51	213.8
715	0.58536	230983	0.1406	0.99892	51	209.9
716	0.58609	230028	0.1411	0.99882	52	217.5
717	0.58657	229398	0.1415	0.99927	51	213.6
718	0.58597	230175	0.1420	0.99890	51	215.9

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
719	0.58635	229679	0.1425	0.99892	51	219.4
720	0.58666	229271	0.1431	0.99876	52	219.5
721	0.58710	228701	0.1434	0.99934	51	213.2
722	0.58793	227616	0.1438	0.99922	52	214.2
723	0.58681	229083	0.1444	0.99876	51	220.5
724	0.58810	227395	0.1447	0.99935	52	215.4
725	0.58834	227079	0.1451	0.99934	52	214.7
726	0.58816	227322	0.1455	0.99909	51	217.1
727	0.58812	227366	0.1459	0.99922	51	217.7
728	0.58883	226446	0.1462	0.99935	52	217.3
729	0.58912	226065	0.1465	0.99936	52	215.9
730	0.58852	226850	0.1468	0.99919	51	214.7
731	0.58837	227048	0.1472	0.99921	51	217.7
732	0.58964	225392	0.1475	0.99934	52	214.5
733	0.58805	227457	0.1481	0.99868	51	222.0
734	0.58871	226608	0.1486	0.99875	51	220.5
735	0.59017	224716	0.1490	0.99932	52	218.8
736	0.58918	225997	0.1496	0.99868	52	223.4
737	0.58957	225481	0.1500	0.99926	51	215.2
738	0.59025	224607	0.1503	0.99926	52	217.3
739	0.58949	225594	0.1507	0.99909	52	215.1
740	0.58962	225418	0.1512	0.99861	52	219.9
741	0.59035	224484	0.1519	0.99902	52	222.4
742	0.59037	224453	0.1525	0.99887	51	221.8
743	0.59068	224059	0.1531	0.99866	51	224.1
744	0.59073	223993	0.1536	0.99887	51	221.3
745	0.59074	223972	0.1543	0.99875	51	221.7
746	0.59168	222761	0.1547	0.99921	51	220.3
747	0.59209	222240	0.1551	0.99918	52	219.6
748	0.59225	222029	0.1556	0.99924	52	218.8
749	0.59182	222585	0.1560	0.99913	51	220.0
750	0.59202	222326	0.1564	0.99924	51	221.5
751	0.59288	221225	0.1567	0.99934	52	218.2
752	0.59261	221568	0.1571	0.99932	52	227.3
753	0.59314	220890	0.1574	0.99926	52	220.0
754	0.59291	221190	0.1578	0.99937	52	218.3
755	0.59306	220998	0.1581	0.99918	52	227.9
756	0.59274	221410	0.1586	0.99902	52	221.9
757	0.59340	220567	0.1590	0.99918	52	223.2
758	0.59390	219923	0.1593	0.99935	52	227.5
759	0.59314	220891	0.1598	0.99904	52	230.6
760	0.59327	220724	0.1602	0.99921	52	220.1
761	0.59332	220668	0.1607	0.99882	52	224.5
762	0.59443	219245	0.1611	0.99937	52	228.5
763	0.59368	220206	0.1615	0.99923	51	221.7
764	0.59354	220382	0.1620	0.99904	51	226.7
765	0.59433	219379	0.1626	0.99894	52	233.2
766	0.59477	218813	0.1630	0.99926	52	230.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
767	0.59449	219171	0.1634	0.99924	51	221.8
768	0.59525	218213	0.1637	0.99929	52	223.2
769	0.59530	218143	0.1641	0.99936	52	229.9
770	0.59508	218423	0.1644	0.99927	52	229.3
771	0.59561	217754	0.1648	0.99926	52	230.1
772	0.59452	219136	0.1654	0.99832	52	229.3
773	0.59527	218181	0.1662	0.99885	51	233.7
774	0.59577	217552	0.1666	0.99925	51	222.0
775	0.59569	217651	0.1672	0.99863	51	231.3
776	0.59572	217610	0.1678	0.99886	51	234.8
777	0.59653	216586	0.1684	0.99875	51	229.3
778	0.59642	216731	0.1691	0.99879	51	230.1
779	0.59670	216381	0.1697	0.99886	51	235.9
780	0.59700	215995	0.1702	0.99907	51	227.2
781	0.59775	215060	0.1707	0.99898	52	236.2
782	0.59811	214600	0.1712	0.99925	52	233.3
783	0.59713	215838	0.1718	0.99867	51	239.8
784	0.59820	214490	0.1723	0.99892	52	228.8
785	0.59856	214037	0.1730	0.99893	52	237.9
786	0.59785	214926	0.1736	0.99868	51	240.9
787	0.59890	213620	0.1741	0.99920	52	236.3
788	0.59844	214191	0.1746	0.99888	51	238.4
789	0.59881	213732	0.1753	0.99864	52	240.2
790	0.59883	213704	0.1761	0.99870	51	238.6
791	0.59952	212847	0.1767	0.99885	52	240.2
792	0.59994	212320	0.1773	0.99902	52	238.3
793	0.60005	212179	0.1779	0.99879	52	241.5
794	0.60026	211921	0.1786	0.99885	52	243.0
795	0.60081	211238	0.1790	0.99920	52	237.9
796	0.60098	211028	0.1796	0.99891	52	238.9
797	0.60126	210676	0.1800	0.99928	52	237.0
798	0.60114	210825	0.1806	0.99879	52	242.0
799	0.60143	210472	0.1813	0.99884	52	244.6
800	0.60139	210517	0.1818	0.99902	52	237.4
801	0.60193	209855	0.1824	0.99875	52	243.4
802	0.60195	209822	0.1832	0.99865	52	243.5
803	0.60297	208569	0.1839	0.99909	52	241.5
804	0.60345	207984	0.1844	0.99898	52	245.0
805	0.60321	208268	0.1851	0.99883	52	242.3
806	0.60338	208060	0.1858	0.99845	52	246.3
807	0.60386	207477	0.1865	0.99890	52	243.0
808	0.60407	207224	0.1871	0.99894	52	241.5
809	0.60406	207233	0.1877	0.99869	52	245.2
810	0.60438	206834	0.1883	0.99893	52	242.2
811	0.60450	206688	0.1888	0.99920	52	239.5
812	0.60453	206654	0.1895	0.99874	52	247.9
813	0.60488	206224	0.1901	0.99899	52	242.8
814	0.60521	205827	0.1905	0.99927	52	241.3

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
815	0.60497	206120	0.1911	0.99883	52	252.5
816	0.60466	206498	0.1918	0.99843	52	247.4
817	0.60579	205116	0.1926	0.99894	52	244.6
818	0.60607	204783	0.1933	0.99872	52	253.8
819	0.60680	203896	0.1938	0.99921	52	251.0
820	0.60642	204347	0.1944	0.99897	52	253.3
821	0.60650	204260	0.1950	0.99877	52	249.6
822	0.60694	203720	0.1956	0.99902	52	253.7
823	0.60684	203847	0.1962	0.99882	52	249.4
824	0.60700	203649	0.1968	0.99901	52	254.1
825	0.60727	203322	0.1974	0.99893	52	247.9
826	0.60810	202312	0.1979	0.99922	52	246.0
827	0.60760	202921	0.1986	0.99868	52	259.2
828	0.60792	202531	0.1993	0.99890	52	255.9
829	0.60829	202085	0.1998	0.99909	52	255.0
830	0.60829	202091	0.2005	0.99878	52	257.7
831	0.60875	201535	0.2011	0.99891	52	256.6
832	0.60880	201479	0.2017	0.99892	52	259.5
833	0.60865	201659	0.2024	0.99865	51	252.4
834	0.60977	200310	0.2030	0.99907	52	259.3
835	0.60995	200089	0.2036	0.99896	52	256.0
836	0.60979	200284	0.2043	0.99876	52	263.4
837	0.60993	200112	0.2049	0.99906	52	256.3
838	0.60994	200111	0.2057	0.99849	52	264.5
839	0.61044	199502	0.2064	0.99903	52	260.8
840	0.61041	199545	0.2069	0.99908	52	256.9
841	0.61075	199136	0.2076	0.99869	52	264.8
842	0.61136	198405	0.2083	0.99903	52	258.8
843	0.61072	199168	0.2090	0.99875	52	262.4
844	0.61132	198456	0.2097	0.99896	52	262.7
845	0.61169	198017	0.2102	0.99908	52	258.9
846	0.61207	197570	0.2109	0.99894	52	264.0
847	0.61213	197498	0.2115	0.99906	52	261.1
848	0.61177	197923	0.2122	0.99871	52	264.3
849	0.61255	196994	0.2130	0.99884	52	266.3
850	0.61319	196235	0.2136	0.99921	52	259.9
851	0.61334	196061	0.2142	0.99896	52	266.2
852	0.61356	195798	0.2148	0.99913	52	259.8
853	0.61333	196074	0.2155	0.99872	52	267.2
854	0.61432	194906	0.2162	0.99905	52	266.2
855	0.61417	195077	0.2167	0.99913	52	262.2
856	0.61431	194919	0.2174	0.99867	52	264.9
857	0.61472	194436	0.2183	0.99870	52	268.4
858	0.61439	194825	0.2191	0.99859	52	268.7
859	0.61557	193429	0.2198	0.99907	52	265.7
860	0.61541	193619	0.2203	0.99903	52	261.3
861	0.61482	194314	0.2210	0.99884	52	262.3
862	0.61579	193171	0.2216	0.99893	52	269.6

Cycle #	Crack Length (in)	Stiffness (lb/in)	Max. COD (in)	Correlation	Number of Data	J Range (in-lb/in ²)
863	0.61534	193702	0.2224	0.99865	52	268.0
864	0.61576	193215	0.2231	0.99894	52	266.2
865	0.61636	192506	0.2237	0.99907	52	267.0
866	0.61674	192065	0.2243	0.99913	52	263.9
867	0.61652	192327	0.2252	0.99856	52	271.9
868	0.61668	192139	0.2258	0.99909	52	266.4
869	0.61695	191815	0.2264	0.99907	52	264.5
870	0.61723	191492	0.2272	0.99877	52	269.1
871	0.61787	190754	0.2278	0.99900	52	268.1
872	0.61768	190972	0.2285	0.99896	52	275.9
873	0.61798	190623	0.2292	0.99882	52	269.4
874	0.61846	190063	0.2299	0.99907	52	271.6
875	0.61834	190208	0.2307	0.99867	52	272.3
876	0.61876	189713	0.2316	0.99856	52	278.3
877	0.61776	190876	0.2322	0.99908	52	269.8
878	0.61712	191621	0.2328	0.99907	52	275.7
879	0.61695	191825	0.2334	0.99902	52	276.9
880	0.61698	191785	0.2341	0.99885	52	278.6
881	0.61773	190912	0.2346	0.99924	52	272.7
882	0.61779	190839	0.2352	0.99888	52	270.8
883	0.61811	190467	0.2358	0.99903	52	277.7
884	0.61838	190155	0.2364	0.99919	52	274.2
885	0.61848	190045	0.2370	0.99899	52	271.3
886	0.61867	189823	0.2376	0.99898	52	269.5
887	0.61853	189981	0.2383	0.99849	52	271.4
888	0.61911	189312	0.2391	0.99907	52	276.4
889	0.61953	188825	0.2400	0.99854	52	275.0

Table C22 Crack Growth Rate Results - Specimen GPQ-25

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
116.9	59974	0.00042
118.3	60332	0.00019
124.4	61868	0.00015
124.0	61769	0.00011
124.9	61993	0.00008
124.8	61968	0.00004
125.6	62166	0.00009
130.8	63440	0.00017
131.3	63561	0.00015
137.0	64926	0.00015
138.2	65210	0.00010
135.6	64593	0.00005
137.5	65044	0.00015
144.4	66656	0.00014
138.3	65233	0.00013
145.4	66887	0.00012
153.1	68635	0.00012
155.0	69060	0.00015
151.7	68321	0.00012
156.6	69415	0.00011
156.4	69371	0.00010
157.7	69659	0.00024
168.7	72047	0.00008
165.5	71360	0.00011
167.5	71790	0.00016
169.4	72196	0.00013
171.4	72621	0.00015
178.8	74172	0.00015
179.9	74400	0.00017
185.9	75631	0.00015
188.5	76158	0.00015
196.5	77757	0.00017
199.2	78289	0.00016
201.7	78779	0.00020
209.6	80307	0.00015
217.5	81807	0.00018
215.9	81505	0.00020
219.6	82201	0.00015
223.2	82872	0.00016
233.3	84726	0.00018
237.0	85395	0.00024
241.5	86202	0.00026
247.9	87337	0.00024
260.8	89580	0.00021
259.9	89426	0.00021

J Range (in-lb/in ²)	K Range (psi*in ^{.5})	da/dN (in/cycle)
267.0	90639	0.00024
276.4	92220	0.00018