This article presents the experimental data supporting the study to obtain the mean strain/stress effects on the fatigue behavior of Ti–6Al–4V ELI. A series of strain-controlled fatigue experiments on Ti–6Al–4V ELI were performed at four strain ratios (−1, −0.5, 0, and 0.5). Two types of data are included for each specimen. These are the hysteresis stress–strain responses for the cycle in a log_{10} increment, and the maximum and minimum stress–strain responses for each cycle. Fatigue lives are also reported for all the experiments.

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Fatigue specimens were machined from a wrought Ti–6Al–4V ELI bar that was annealed for 1 h at 1300 °F. The round specimens with reduced uniform gage section were further polished to 4000 FEPA surface finish. M-coat D was used as a protective coating on the gage section to prevent extensometer blades from causing any damage on the specimen during testing.

Strain-controlled fatigue tests were performed according to ASTM E606-04 [1]. Test Frequencies were adjusted to eliminate any temperature and strain rate effects. All test were conducted at room temperature with an average relative humidity of 41%.

Center for Advanced Vehicular Systems (CAVS), Mississippi State University, Mississippi State, MS, USA

Data is within this article.
2. Experimental design, materials and methods

Fatigue specimens were machined from Ti–6Al–4V ELI Grade 5 round bar with 12.7 mm diameter to create round-shaped specimens with a reduced uniform gage section. The geometry and dimensions of the specimens, as illustrated in Fig. 1, were designed to comply with ASTM standard E606/E606M–12 [1]. Fatigue tests were performed at four strain ratios, including $R_\varepsilon = -1$ (fully-reversed), $R_\varepsilon = -0.5$ (tension–compression), $R_\varepsilon = 0$ (tension-release), and $R_\varepsilon = 0.5$ (tension–tension). For each strain amplitude, a minimum of two fatigue experiments were conducted to ensure that the test data

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Table 1
Ti-6Al-4 V ELI summary of strain-controlled fatigue tests.

| Specimen ID | $R_\varepsilon$ | $\varepsilon_a$ (mm/mm) | $2N_f$ (Reversal) |
|-------------|-----------------|--------------------------|------------------|
| Fully-Reversed Tests | | | |
| sa 0.012 (1) | -1 | 0.012 | 2202 |
| sa 0.012 (4) | -1 | 0.012 | 2336 |
| sa 0.012 (5) | -1 | 0.012 | 3164 |
| sa 0.010 (2) | -1 | 0.010 | 3986 |
| sa 0.010 (4) | -1 | 0.010 | 4540 |
| sa 0.010 (5) | -1 | 0.010 | 3760 |
| sa 0.008 (1) | -1 | 0.008 | 14,338 |
| sa 0.008 (2) | -1 | 0.008 | 12,914 |
| sa 0.007 (3) | -1 | 0.007 | 49,812 |
| sa 0.006 (3) | -1 | 0.006 | 124,952 |
| sa 0.006 (5) | -1 | 0.006 | 207,610 |
| sa 0.006 (6) | -1 | 0.006 | 128,050 |
| sa 0.005 (1) | -1 | 0.005 | > 2,713,156 |
| sa 0.004 (1) | -1 | 0.004 | > 4,431,694 |
| sa 0.004 (2) | -1 | 0.004 | > 2,337,270 |

| Mean Strain Tests | | | |
|-------------------|-----------------|--------------------------|------------------|
| sa 0.010 (1) R0 | 0 | 0.010 | 5464 |
| sa 0.010 (2) R0 | 0 | 0.010 | 6724 |
| sa 0.008 (1) R0 | 0 | 0.008 | 13,992 |
| sa 0.008 (2) R0 | 0 | 0.008 | 11,398 |
| sa 0.006 (1) R0 | 0 | 0.006 | 57,292 |
| sa 0.006 (2) R0 | 0 | 0.006 | 65,472 |
| sa 0.004 (1) R0 | 0 | 0.004 | > 2,506,668 |
| sa 0.009 (1) R -0.5 | -0.5 | 0.0090 | 11,546 |
| sa 0.009 (2) R -0.5 | -0.5 | 0.0090 | 10,516 |
| sa 0.0075 (1) R -0.5 | -0.5 | 0.0075 | 22,700 |
| sa 0.0075 (2) R -0.5 | -0.5 | 0.0075 | 22,992 |
| sa 0.006 (3) R -0.5 | -0.5 | 0.0060 | 128,248 |
| sa 0.0045 (1) R -0.5 | -0.5 | 0.0045 | > 2,371,298 |
| sa 0.0045 (4) R0.5 | 0.5 | 0.0045 | 64,066 |
| sa 0.0045 (6) R0.5 | 0.5 | 0.0045 | 98,788 |
| sa 0.004 (3) R0.5 | 0.5 | 0.0040 | 230,884 |
| sa 0.004 (4) R0.5 | 0.5 | 0.0040 | 129,922 |
| sa 0.003 (2) R0.5 | 0.5 | 0.0030 | > 2,370,558 |
| sa 0.003 (3) R0.5 | 0.5 | 0.0030 | > 2,104,146 |
| sa 0.0025 (4) R0.5 | 0.5 | 0.0025 | > 2,319,500 |
| sa 0.0020 (1) R0.5 | 0.5 | 0.0020 | > 2,047,510 |
| sa 0.0015 (5) R0.5 | 0.5 | 0.0015 | > 2,048,000 |

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reported for all the experiments. All the data has been deposited to the Data in Brief (DiB) Dataverse: http://dx.doi.org/10.7910/DVN/EXS3F5.
was consistent. The strain amplitudes, \( \varepsilon_a \), ranged from 0.0015 to 0.012 mm/mm depending on the applied \( R_e \). All tests were conducted at room temperature with an average 41\% relative humidity, and using a servohydraulic test machine with a sinusoidal waveform input. The test frequency was adjusted for each strain amplitude to eliminate any temperature and strain rate effects on the cyclic behavior. Experiments that reached over \( 10^6 \) cycles were determined to be a run-out and no duplicate test was performed. For some long life tests in the fully elastic region where the cyclic stress response was constant, the control mode was switched to load-control and the test frequency was increased to reduce the testing time. Table 1 summarizes the compiled data information for all strain-controlled fatigue tests, which were organized by the strain ratio, \( R_e \), and the strain amplitude, \( \varepsilon_a \).

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**Appendix A. Supplementary material**

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2016.02.014.

**References**

[1] ASTM Standard E606/E606M – 12, Standard Test Method for Strain-Controlled Fatigue Testing, ASTM International, West Conshohocken, PA, 2012.

[2] R.I. Stephens, A. Fatemi, R.R. Stephens, H.O. Fuchs, Metal Fatigue in Engineering, John Wiley & Sons, 2000.