Ultrasonic Fatigue Testing System with an Average Stress Loading Mechanism

For Gigacycle Fatigue Tests with Average Stress Loaded

Actual components are rarely used under conditions in which the average stress is zero. Despite this, the USF-2000A, a standard ultrasonic fatigue testing system, can only perform testing under zero average stress conditions. Using an ultrasonic fatigue testing system equipped with an average stress loading mechanism, gigacycle fatigue tests can be performed with average tensile stress loaded.

System Appearance

Ultrasonic Fatigue Testing System Effective for Gigacycle Fatigue Tests

With fatigue tests of high-strength steels, it is evident that internal fracture (fish-eye fracture), which is caused by inclusions and other micro defects, occurs at 107 cycles or more, a value considered the conventional fatigue limit. An ultrasonic fatigue testing system is extremely effective when performing this sort of gigacycle fatigue test. (With a 100 Hz fatigue testing system, this would take 3 years, but if a 20 kHz ultrasonic fatigue testing system is used, testing can be completed in one week.)
Main Specifications

1) Test Frequency: 20 kHz ± 500 Hz
   • The recommended test range is 20 kHz ± 30 Hz.
   • The test frequency is determined by the resonance frequency of the sample.

2) Horn End Face Amplitude
   Min. approx. ±10 µm  
   Max. approx. ±50 µm
   • The minimum and maximum amplitudes are the end face amplitude values at amplitude outputs of 20% and 100% respectively. Accordingly, the minimum and maximum amplitude values will change somewhat depending on the shape of the sample.

3) Test Stress
   Standard circular tapered sample
   Stress
   Min. 237 MPa
   Max. 1186 MPa
   • The test stress range can be changed by changing the sample shape.
   • The minimum and maximum values are calculated with the end face amplitude values of 10 µm and 50 µm respectively.
   • These are the values when the stress is within the elasticity range.

4) Average Stress
   Max. 1.5 kN (tensile only)
   • Average stress loads exceeding 1.5 kN are possible, but will have an impact on the service life of the horn.

Components

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| 1 | Ultrasonic resonance system  
   Power supply, converter, booster (1 pair), horn (1 pair) |
| 2 | Personal computer  
   (OS Windows 7) ADA/PIO interface board |
| 3 | Software  
   Ultrasonic test control measurement software |
| 4 | Cooling system  
   Air dryer, air piping  
   • A separate 140 L/min air source is required. |
| 5 | Strain meter unit (option) |
| 6 | AG-X plus Autograph 5 kN + 250 extension |
| 7 | Average stress loading mechanism |