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JAPANESE INDUSTRIAL STANDARD

Method of high temperature low cycle fatigue testing for metallic materials

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Method of high temperature low cycle fatigue testing for metallic materials

1. Scope

This Japanese Industrial Standard specifies the method of fatigue testing by the single shaft tension and compression under a specified controlled range of strain, to determine the low cycle fatigue lift of metallic materials at high temperature.

2. Definitions of terms (symbols)

For the purposes of this standard, the definitions of the main terms (symbols) are as follows.

(1) stress (σ) The value is obtained by dividing the axial load of the test piece by the original cross section of the test piece, as is calculated by the following equation.

$$\sigma = \frac{P}{A_0}$$

where, σ : stress [(MPa) or (N/mm²)]

P : axial load (N) (positive for tension and negative for compression)

A_0 : original cross section of test piece (mm²)

(2) total strain (ε_t) The value is obtained by dividing the difference of the gauge length after deformation and the initial gauge length of the test piece by the initial gauge length of the test piece, as is calculated by the following equation.

$$\varepsilon_t = \frac{l - l_0}{l_0}$$

where, ε_t : total strain [(mm/mm) (dimensionless) or (%)]

l : gauge length of test piece after deformation (mm)

l_0 : initial gauge length of test piece (mm)

Remarks: The initial gauge length l_0 shall be, in principle, the gauge length that is observed by heating the test piece to the test temperature after attaching an extensometer to the test piece. However, if the initial gauge length cannot accurately be measured, the gauge length at room temperature may be used instead.

The maximum and minimum values of the total strain are represented by $\varepsilon_{t\,max}$ and $\varepsilon_{t\,min}$, respectively.

(3) elastic strain (ε_e) The elastic component of the total strain. The value is obtained by dividing the stress σ by the modulus of longitudinal elasticity (Young's modulus), as is calculated by the following equation.

$$\varepsilon_e = \frac{\sigma}{E}$$

where, ε_e : elastic strain [(mm/mm) (dimensionless) or (%)]

σ : stress [(MPa) or (N/mm^2)]

E : modulus of longitudinal elasticity (Young's modulus) [(MPa) or (N/mm^2)]

Remarks: The maximum and minimum values of the elastic strain are represented by $\varepsilon_{e\,max}$ and $\varepsilon_{e\,min}$, respectively.

(4) inelastic strain (ε_{in}) The value is obtained by subtracting the elastic strain from the total strain, as is calculated by the following equation.

$$\varepsilon_{in} = \varepsilon_t - \varepsilon_e$$

where, ε_{in} : inelastic strain [(mm/mm) (dimensionless) or (%)]

ε_t : total strain [(mm/mm) (dimensionless) or (%)]

ε_e : elastic strain [(mm/mm) (dimensionless) or (%)]

Remarks: The maximum and minimum values of the inelastic strain are represented by $\varepsilon_{in\,max}$ and $\varepsilon_{in\,min}$, respectively.

(5) tensile peak stress (σ_{max}) Maximum stress

(6) compressive peak stress (σ_{min}) Minimum stress

(7) stress range ($\Delta\sigma$) The value is obtained by subtracting the compressive peak stress from the tensile peak stress, as is calculated by the following equation.

$$\Delta\sigma = \sigma_{max} - \sigma_{min}$$

where, $\Delta\sigma$: stress range [(MPa) or (N/mm^2)]

σ_{max} : maximum stress [(MPa) or (N/mm^2)]

σ_{min} : minimum stress [(MPa) or (N/mm^2)]

(8) mean stress (σ_m) The value is the mean of the tensile peak stress and the compressive peak stress, as is calculated by the following equation.

$$\sigma_m = \frac{\sigma_{max} + \sigma_{min}}{2}$$

where, σ_m : mean stress [(MPa) or (N/mm^2)]

σ_{max} : maximum stress [(MPa) or (N/mm^2)]

σ_{min} : minimum stress [(MPa) or (N/mm^2)]