

# " Characteristic *S-N* Property of High Carbon Chromium Bearing Steel under Axial Loading in Long Life Fatigue "

Yosuke Sato

In the reliability design of mechanical structures, fatigue characteristics of their components in the long life region are required as fundamental data. Such fatigue data have been obtained for various metallic materials by many researchers in rotating bending due to the technological restriction. Since various loading types can be applied to actual components, the push-pull axial loading is important as a fundamental loading type.

From this viewpoint, fatigue tests in the axial loading were performed to clarify long life fatigue characteristics of high carbon chromium bearing steel. The *S-N* curve thus obtained was compared with the results in rotating bending. All the failed specimens were carefully observed by means of an SEM, paying an attention to the crack initiation and propagation mechanisms. The effect of stress ratio on long life fatigue characteristics of this steel was also discussed.

Main conclusions obtained in this study are summarized as follows;

- (1) The long life fatigue properties of the high carbon chromium bearing steel were experimentally examined in axial loading, and the duplex *S-N* characteristics consisting of the surface-induced fracture and the interior inclusion-induced fracture were found to be similar to the corresponding properties in rotating bending at every stress ratio.
- (2) In the case of interior inclusion-induced fracture, a clear fish-eye was observed on the fracture surface. Non-metallic inclusion was always found at the center of the fish-eye and a fine granular area (FGA) was observed in the vicinity around the inclusion in a lot of fractures. The value of  $\Delta K_{FGA}$  corresponds to the threshold value of the crack propagation.
- (3) In both types of surface-induced fracture and interior inclusion-induced fracture, the following three areas were necessarily observed; (i) a flat surface area at the initial stage, (ii) a rough area outside the initial flat area and (iii) a wide fracture surface having the radial ridge pattern outside the rough area.