［様式－学 5］

主　論　文　要　旨

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論文題名

Fatigue Behavior and Fracture Mechanism of High Strength Steels under Rotating Bending in Very High Cycle Regime

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主論文要旨

The grave accidents in the use of mechanical structure caused by fatigue fracture happened quite frequently. From a viewpoint of safety for long term use of the mechanical structures, it is necessary to clarify the fatigue property of steels. According to the recent researches in the area of very high cycle fatigue (VHCF), some high strength steels indicate a characteristic "duplex S-N property" such that the S-N curve tends to come down again in the long life region of N>10^7. This fact suggests us that the conventional fatigue design based on the fatigue limit at N=10^7 cycles does not provide the safety design of mechanical structures.

Due to the background discussed above, the fatigue tests for two kind of high strength steels, SUJ2 and SNCM439, are carried out using the notched specimens by a dual-spindle rotating fatigue testing machine in the very high cycle regime. Based on the experimental results, the fatigue behavior is confirmed with a fractography method and the fatigue fracture mechanism is discussed from a viewpoint of fracture mechanics.

The main results obtained in this study are summarized as below:

1. Based on the long term experiments, the characteristic "duplex S-N property" was confirmed for specimens tested in this study.
2. The statistical fatigue property was analyzed. It was confirmed that the fatigue life with "duplex S-N property" is well governed by the mixed-mode Weibull distribution.
3. The fatigue fracture mechanism was clarified based on a fractography method. The fatigue behavior of interior inclusion initiated fracture was evaluated theoretically based on the FGA model.
4. The fatigue behavior was also examined for the ultra clean bearing steel SUJ2 with a control of non-metallic inclusion size. It was confirmed that the fatigue life was improved by downsizing of the inclusion.