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Microstructural Approach to Fatigue Behavior of Induction-hardened Steel

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In recent years it has been well known that the remarkable improvement on fatigue strength of carbon steel specimen which was induction-hardened, can be due to

1) an improvement on mechanical properties of material by rapid heating,

2) a prevention of the propagation of fatigue crack by the existence of residual compressive stress in the surface layer of specimen.

However, at the stage of the initiation of macro- or microscopic fatigue crack, it has not become obvious what kind of role the residual compressive stress in the surface layer of specimen plays, and what kind of effect the rapid heating has. Then, in this paper, fatigue behavior of induction-hardened microstructure which is free from the residual compressive stress, was investigated. And the effect of structural change of material due to the induction hardening on the fatigue strength, was observed.

Results obtained are summarized as follows. The improvement on fatigue limit of induction-hardened specimen, released from residual compressive stress is not so remarkable as the specimen which has residual compressive stress, and improvement on fatigue behavior has hardly been influenced by the heating duration of rapid heating. And it is considered that existence of retained ferrite plays a very important role. The microscopic fatigue crack, originated from the slip band, was actually observed just in the retained ferrite under the microscope and also the developing feature of it was pursued with repetition of loading.

And the meaning of the fatigue limit was observed from the metallurgical view point.

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