

About the damage tolerance of railway axles under compressive residual stress

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Abstract

Japanese railway axles developed the surface induction quench technology, which can produce the compressive residual stress and gradually changed hardness inside the material. However, few papers investigated the fatigue cracking behaviors in the presence of compressive residual stress within the elastic fracture mechanics. An iterative approach was firstly employed to build the stress field. The stress intensity factor (SIF) along the crack front inside the hollow axle was then evaluated under a constant surface crack aspect ratio. Residual fatigue life of quenched axles was predicted under different external loading in terms of standard Paris law. It is found that the compressive residual stress can highlight the fatigue cracking force. Moreover, the predicted fatigue life is well agreement with results from published literature.

Key words: Fatigue crack propagation rate; Induction hardening axle; Residual compressive stress; Damage tolerance; Railway axles.

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