

Surface roughness effect on fatigue strength of aluminum alloy using revised stress field intensity approach

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Abstract

The fatigue strength of component is known to highly depend on its surface quality and it is very necessary to develop a reliable appropriate mathematical model for fatigue strength assessment considering the effect of surface roughness. In this paper, different underlying physical mechanisms of roughness effect at different regions of specimen were studied by the fatigue test of 7N01 aluminium alloy. For quantitative analysis of the surface roughness effect, a revised stress field intensity approach for fatigue strength assessment of micro-size notch was proposed as the theoretical support. In the new model, a new form of weight function was built to adapt the characteristics of micro-size notch. In addition, the effect of the field radius is weakened fundamentally on solution of the stress field intensity and the difficulty of fatigue failure region definition in traditional method is overcome correspondingly in the proposed model, which makes the calculated field strength accurate and objective. Finally, to demonstrate the validity of the revised approach quantitatively, specimens with notches in conventional size have been subjected to stress field intensity calculation. The results show that the revised approach has a satisfactory accuracy compared with the other two traditional approaches from the perspective of quantitative analysis.

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