Residual life assessment of incomplete fusion defects in welded bogie frame

based on fracture mechanics

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Abstract

Key welded joints' fatigue has been one of critical factor which restricts the reliable operating and recondition cost of bogies. However, the existence of weld defects reduce the strength of bogie seriously, such as penetration, solid inclusions, cavities and misalignment. It is necessary to introduce the fracture mechanics based damage tolerance approach for the assessment on welded bogie with incomplete fusion defects, which always appear in welding. Based on traditional nominal stress method, the static strength of the bogie was calculated according to UIC615 loading criteria, and assessment of welded joints was completed with Goodman fatigue limit diagram. By using the singular finite element method, the stress strength intensity factor ΔK of welded joint included incomplete fusion was analyzed. Meanwhile, center cracked sheet testing located at different area of welded joint were conducted to acquire threshold of stress strength intensity factor ΔK_{th} and fatigue crack growth rate da/dN. Finally, contrasting the value of ΔK and ΔK_{th} indicates that weld joint in bogie is safe enough to use for 35 years.

Keywords: Welded bogie frame; Incomplete fusion; Damage tolerance; Fatigue crack propagation; Residual life; FEM