Fatigue damage of 2024-T351 aluminium alloy friction stir welding joints. Part 2: fatigue damage

ABSTRACT

The characterisation of micro and macro mechanics in 2024-T351 (Al Alloy) FSW joints was conducted to identify the critical regimes for natural fatigue crack initiation in 2024-T351 Al Alloy FSW welded joints and was presented in Part 1. In this Part, the fatigue tests were performed. Scanning electron microscopy analysis on fracture surfaces revealed that natural crack initiates from multiple sites and is propagated through different regimes causing coalescence. Replicas of crack images confirmed that multiple cracks coalesce. The natural fatigue initiation sites which were found begin from subsurface defects rather than form a free surface. For a different applied stress level, the initiation sites were changed from one regime to another. The number of cracks observed reduces as the applied stress drops. The fatigue limit of this welded joint was governed by a coalescence of the cracks rather than by the propagation.