

IN SITU PROBING OF CRACK GROWTH RETARDATION DURING CYCLIC LOADING

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During a constant-amplitude fatigue-crack-growth experiment, a single tensile overload was applied and a large retardation period was observed, resulting in a temporary decrease in the crack growth rate. In order to explain the crack growth retardation, several mechanisms have been proposed but the precise micromechanical mechanisms that account for these phenomena are still not fully understood. In this investigation, in-situ electric potential and neutron diffraction measurements were performed to probe the mechanism of overload effects. Electric potential technique enables us to measure the exact crack length at each cycle during fatigue crack growth. Using this method, the crack opening load was determined at various stages including retardation period during fatigue crack growth. In addition, spatially-resolved neutron strain scanning was performed to measure the evolution of internal strains around a crack tip during in-situ loading. The crack opening level was investigated at different stages through retardation period from the plot of load versus lattice strain. From both techniques, the relationship between crack tip driving force and crack growth rate is revealed.

Keywords: Overload; Crack growth retardation; Electric potential; Neutron diffraction