

An Experimental Study on the Elastic-Plastic Fracture in a Ductile Material under Mixed Mode Loading

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Abstract

A stereo vision was used to measure the crack tip parameters, such as J integral, plastic mixity, and elastic mixity, of mixed mode fracture specimens, and to study the applicability of the Shih' s plane strain solution to the mixed mode crack tip fields. The fracture specimen used in the paper is a compact tension shear (CTS) specimen made of 2024-0 aluminum. The in-plane strain and stress fields near the mixed mode crack tip of the CTS specimen were determined using the deformation field measured by the stereo vision. It is observed that the J integral values computed along rectangular contours surrounding the mixed mode crack tip approach constant after $r/h > 0.5$. The in-plane strains determined experimentally at several points near the crack tip and at several radial lines emerging from the crack tip are compared with the values calculated using Shih' s plane strain solution and compared with the HRR slope, respectively. It is found that the measured values follow the trends of the Shih' s plane strain solution. The elastic mixity evaluated using the measured crack tip stress fields is close to that obtained from analytical solution. However the evaluated plastic mixity deviates from the analytical solution.

Keyword : CTS specimen, stereo vision, J integral, HRR field