Observations of the Severity of Notch-Root Radius in Initiation of Subcritical-Crack Growth

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SUMMARY

Slow bend tests were conducted on Charpy specimens containing precracks or machined notches of 0.10 or 0.25 mm radius. The test specimens were fabricated from three heats of annealed Type 304 stainless steel. The purpose of these tests was to examine the effects of notch root radius, in very ductile materials, on initiation of subcritical crack growth. In addition, it was intended to establish the critical values of J, COD, etc. for the single-edge notch specimen for comparison with results obtained from specimens containing surface flaws. This paper will briefly describe only those results of the calculation for J. The tests were monitored by acoustic emission to identify the load corresponding to initiation of subcritical crack growth, by a crack-opening displacement gage (COD), by cross-head displacement, and by stop-action photography.

Previous tests have shown a substantial increase in the notch-root radius prior to initiation of subcritical crack growth. But, tests of the Charpy specimens have shown a negligible increase in notch root radius prior to initiation of subcritical crack growth. But, there was a substantial increase in the notch-root radius prior to attainment of the maximum load. The loads corresponding to initiation of subcritical crack growth are similar for precracked specimens where the ratio of crack depth (a) to specimen depth (w) is 0.23 and machined notch specimens where a/w = 0.20.

Charpy specimens that had fatigue precracks varying from a/w = 0.23 to 0.71 were used to calculate J. The results are higher than those obtained using specimens containing surface flaws. It has not been possible to obtain a value of J_{crit} from the Charpy specimens due to the shape of the plot of J versus deflection and the substantial range of the deflection corresponding to initiation of subcritical crack growth.

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