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Potential drop method for online crack length measurement during fracture testing: Development of a correction procedure

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Abstract

Though the potential drop method is included in testing standards for creep and fatigue crack growth, it is not used in fracture toughness tests because it overestimates the crack length during the initial loading due to crack tip plastic deformation. In the present paper, a procedure is proposed for correcting for this by using the blunting line equation and stretch zone width, a physical parameter as the reference. Compact tension samples of three different thicknesses were employed. The results after correction are compared with those from the standard methods, viz., elastic unloading compliance and normalization methods.

Keywords: Crack length measurement, Stretch zone, Plasticity, DCPD

Highlights

- A procedure is proposed to correct overestimation of crack length by DCPD.
- Procedure uses blunting line equation and measured stretch zone width.
- Application of this procedure to fracture test data on SS 316L(N) is demonstrated.
- The J-R curve results compare favorably with those from standard methods.

1 Introduction

J - integral is a widely used parameter for charactering fracture behaviour of ductile materials. Though the testing standards for J -R curve determination are established, still a lot of work is going on to increase the efficiency of these methods. ASTM E 1820 [1] is a widely used standard for J evaluation. Fracture testing for evaluation of J includes pulling of sample under displacement controlled conditions and simultaneous acquisition of load (P), displacement, (v) and crack length (a) data. Acquiring P and v data is a routine matter with the present day testing machines with digital controller and integrated data acquisition systems while online crack growth monitoring is a relatively tedious task,. It is essential to use a reliable yet simple method of online crack length measurement.

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