

Effects of Unloading Rate and Relaxation on Elastic-plastic Resistance Curve Tests

P.B.S. Bailey

Instron Dynamic Systems, Coronation Road, High Wycombe, HP12 3SY, UK.

peter_bailey@instron.com

This paper presents results of an investigation into the combined effects of material relaxation and unloading speed, when conducting J-R curve toughness tests by the unloading compliance method. A proposal is made for a modified method which may give results which are more reliably comparable, and with a reduced test time.

The use of J-R and CTOD-R curve tests is well used in both industrial and research analysis of fracture toughness for more ductile metals and weldments. Standardised test methods have changed little in nearly two decades. Today, the unloading compliance method, using a single specimen to generate one curve, is popular and widely used, primarily due to the high efficiency in both material and time. Many researchers consider the use of multiple specimen tests (for a single R-curve), or DCPD crack length measurement, to be more reliable, but this is often not a pragmatic solution.

For such a well-established test, a surprisingly large variability is still considered acceptable by the community who use it; in part this is a fair representation of its sensitivity to material variability, but are our methods adding excessively to this?