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A New Approach to Control Running Fracture in Pipelines #141
Contract Number: DTRS56005-T-0003
Quarterly Report
December 2005 – February 2006
Battelle

Activities in the during the fifth quarter focused on characterizing the energy dissipation and stretching involved in the fracture process in pipeline steels.

The evolution in steel making and pipe fabrication processes has lead to increases in the fracture toughness of linepipe. In previous research, Battelle showed via instrumented Charpy impact tests on nine steels ranging in vintage and toughness that the total energy dissipated during the impact consists of contribution from (1) deformation at the notch tip and throughout the specimen, (2) dynamic crack initiation, and (3) dynamic crack propagation. These data show that the fraction of the total energy dissipated by crack propagation decreases to near zero with increasing toughness. The decrease in the energy dissipation due to crack propagation has been taken into account in the arrest prediction software being developed.

An equally noteworthy finding was that the energy associated with deformation is near zero for the lower toughness, vintage pipeline steels and that it increases to approximately half of the total energy dissipated for the higher toughness, modern steels. This trend suggests that deformation is equally likely to dissipate considerably more energy in full-scale pipe fracture events of vintage steels than the more modern steels. In addition, correlations between the dissipation due to plastic deformation and grade, Charpy toughness, yield-to-ultimate stress ratio, and true fracture strain at failure were assessed.