

**A Probabilistic Approach to the Modeling of Coarse Grain Heat Affected Zone Fracture
in A707 Steel Welds**

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Abstract

A probabilistic framework is presented for the modeling of the variability in crack-tip opening displacement (fracture toughness) during the fracture of coarse grained heat affected zones in A707 steel welds. The variability in inclusion distribution and fracture conditions is modeled using weak link statistics in physically-based fracture mechanics models that describe the fracture behavior in the lower-shelf and transition-temperature regimes. The models are used to explain the measured trends in experiments designed to explore the effects of heat input on crack-tip opening displacement. The implications of the results are also analyzed for the design of welded structures.