

Residual Stresses and Failure in a Welded Cobalt-Molybdenum HCP Alloy

Peter Huson, University of California, San Diego
Everett Criss, University of California, San Diego
Bimal Kad, University of California, San Diego
Michael B. Prime, Los Alamos National Laboratory, ESA-WR

The effect of residual stresses in the failure of a cobalt-molybdenum welded material has been investigated numerically and experimentally. The proposed simulation method incorporates a sequentially coupled thermal-stress finite element model utilizing the “element birth and death” technique to simulate effects of multi-pass welding procedures. The FE models are evaluated through various residual stress measurement techniques, including the crack compliance method, the contour method and neutron diffraction. Of particular interest is the behavior of a heat treated 90-10 wt% Cobalt-Molybdenum alloy, which has been designed to experimentally surrogate residual stress distributions and failure mechanisms in beryllium welded structures. Surrogate selection has been validated through x-ray diffraction, scanning electron microscopy and thermal-mechanical material characterization.