Complementary Residual Stress Measurement Techniques

M.L. Steinzig*, M.B. Prime, T.A. Sisneros, B. Clausen, C.F. Chen, J. Dereskiewicz
Los Alamos National Laboratory, Los Alamos, NM, USA

Gas tungsten arc (GTA) welds in tritium storage vessels provide potential locations at which hydrogen-assisted slow crack growth can occur, both due to the existence of annealed microstructure in the heat affected zone (which is more vulnerable to tritium embrittlement) and due to the presence of weld residual stresses. Measurements were made to quantify the residual stresses using multiple measurement techniques (hole drilling, neutron, and contour) and results from a finite element model were compared to the measurements. In this case, the weld stop and start locations become critical. The results indicated an obvious but often overlooked point; typical situations with the use of a part may mean that the a single measurement or even a set of measurements will not suffice to identify the *critical* value of residual stress, which may be dependent on magnitude or location or both. Since it is never possible to measure the entire state of residual stress, careful consideration of the critical RS location, and the best technique to measure it is a key aspect to laying out an approach to solving a residual stress problem. Practitioners of residual stress measurements benefit from being able to exploit the benefits of multiple techniques rather than relying the strengths of a single technique.