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Resolving the evolution of pore structures in 304-L laser welds

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ABSTRACT

The failure of partial-penetration Nd:YAG laser welds in 304-L stainless steel have been investigated through the direct incorporation of pore structures at the specimen level. Microcomputed tomography is employed to characterize multiple weld schedules and develop idealized representations of the size, shape, and spacing of the pores. Pore growth and the subsequent necking are natural outcomes of the simulation. The large deformations between pores require a robust mapping scheme for the remeshing and mapping of internal state variables [1]. We employ higher-order tetrahedral elements to resolve strong gradients and ease the burden of discretizing complex and evolving pore structures. Through our ability to idealize, resolve, and evolve pore structures, we can investigate the performance of candidate weld schedules. Sandia National Laboratories is a multiprogram laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

REFERENCE

[1] Mota, A., Sun, W., Ostien, J.T., Foulk III, J.W., Long, K.N. *Computational Mechanics*. 2013, 52, 6.