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Deformation and stress control study on H-beam welded by ultra high-strength steel

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ABSTRACT

With the demand of safety and lightweight for automobile industry, the welded H-beam structure used for automobile frame trends to be fabricated by ultra high-strength steel gradually. However, deformation and stress are still a big issue for welding manufacture of H-beam by ultra high-strength steel. In this study, H-beam deformation and welding residual stress of BS960, which were recently developed by Baosteel Group Corporation, were investigated by numerical simulation and experimental test. A three-dimensional (3D) thermo-mechanical finite element model of submerged arc welding on H-beam structure of BS960 was proposed, which considered double ellipsoidal heat source, temperature-dependent material physical and mechanical properties, phase transformation on thermo-mechanical distribution, and stress relaxation in the weld molten pool. The simulation results, including both temperature and residual stresses, were validated by experimental test. Based on the developed model, the effects of heat input, welding sequence, welding direction, and restraint form on deformation and residual stresses of H-beam structure were studied. The optimal welding parameters were finally obtained by the numerical analysis and the experimental verification. The results showed that combining with numerical model and experiment test the deformation and residual stress of H-beam welded by ultra high-strength steel could be controlled effectively.

KEYWORDS: H-beam welded, ultra high-strength steel, deformation and residual stress, numerical simulation