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Dissimilar Metals Welding Simulation using FEA

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ABSTRACT

Heat flow during welding can strongly affect phase transformations on the base metals and, therefore, the microstructure and properties of the welded joint. It is also responsible for weld residual stresses and distortions. For this reason, visualization of the temperatures distribution during welding process is very important to estimate the heat affected zone width, peak temperatures in the HAZ regions, molten pool temperature and, hence, the effects on metallurgical and mechanical characteristics of the welded joints. By applying these generalities in choosing a welding process and selecting welding variables, the welding engineer can often alter the nature and the extent of the metallurgical changes in the heat-affected zone to produce a more satisfactory joint.

Several theoretical and practical investigations on heat flow in the dissimilar metals welded joints are presented in this paper. Using thin plates, temperature variation in the thickness direction is negligible, and heat flow is considered two-dimensional. Carbon steel and stainless steel are used for the theoretical and practical studies.

An actual theoretical method using finite element analysis is availed for the temperatures prediction in the welded joints. Convection and radiation influences, thermo-physical properties depending on the temperature are considered in the mathematical model proposed by the authors. Because of different thermo-physical values of the base metals, heat flow is asymmetrical with respect the welding direction.

Several measurements and visualization of the temperatures distribution have been made during dissimilar metals welding. Infrared thermography, a non-contact temperature measurement method, is the technique of creating fully analyzable images, from the thermal radiation given off by a subject, by means of an infrared camera. Because of many applications in industry and measurements with great accuracy, this method has been selected for the analysis of the heat flow, molten pool shape, and thermo-physical properties influence on the heat affected zone extent.

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