COMPARATIVE SIMULATION BY FINITE ELEMENT ANALYSIS OF CONVENTIONAL AND TANDEM SUBMERGED ARC WELDING

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ABSTRACT

Submerged arc welding (SAW) is one of the most productive methods applied for joining thick sections used in the industry of pipelines, shipbuilding, offshore platforms. However, the producers of equipment worldwide have looked for technical solutions to develop more efficient and more competitive systems which make possible welding with multiple wires technique - such as Twin, Tandem or Twin-Tandem SAW - in order to achieve greater productivity of the welding process. This paper presents a comparative analysis of heat and Von Misses stress fields developed by conventional and tandem SAW in butt welded joints of API 5L X70 pipelines steel. The sheets of 12mm thickness were machined and welded in X-groove, the root pass being performed by Gas Metal Arc Welding (GMAW) and the filling passes by conventional or tandem SAW. Based on the finite element method, two 3D coupled thermo-mechanical models have been developed in order to investigate the thermo-mechanical behaviour of the base material and to validate the single wire and multi-wire SAW technologies designed in this work. A comparative analysis in terms of the temperature and Von Mises stress distribution, the history and variation in cross section of the welded joint at different time steps are discussed. Taking into account the numerical results achieved by simulation and the role of heat generated by the welding process, several conclusions on temperature and Von Mises stress evolution are finally drawn.

KEYWORDS: multi-wire SAW, finite element analysis, temperature, stress.

ACKNOWLEDGEMENTS

This work was supported by the Romanian National Authority for Scientific Research, CNDI– UEFISCDI, through grant 27/2012, project number PN-II-PT-PCCA-2011-3.1-1057.

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