

Thermal analysis on a weld joint of aluminium alloy in gas metal arc welding

ABSTRACT

In this paper, a three-dimensional finite element model has been developed to simulate dynamically the gas metal arc welding (GMAW) process of aluminium alloy sheets. The numerical simulation was conducted using a non-linear transient thermal analysis by changing the welding parameters: namely arc power and welding speed. A moving Gaussian distributed heat source is implemented. All major physical phenomena associated with the GMAW process, such as thermal conduction and convection heat losses are taken into account in the model development. The developed model can calculate the temperature field and predict the weld geometry profile during the welding process. The measurement of weld bead profile from the GMAW experiments was used to validate the developed finite element model. The numerical study reveals that the arc voltage and welding speed have a significant influence on the temperature distribution, weld pool size and shape, and weld bead geometry. The results show that there are good agreements with the weld bead profile between the experimental observation and finite element simulation.

Keyword: Gas metal arc welding; Aluminium alloy; Weld bead profile; Finite element model; Thermal analysis