

Heat Transfer Mode and Effect of Fluid Flow on the Morphology of the Weld Pool

Abdel Halim ZITOUNI, Pierre SPITERI, Mouloud Aissani, Younes Benkheda

Abstract: In this work, the heat transfer by conduction and convection mode, effect of the fluid flow on the morphology of the weld pool and the welding properties are investigated during Tungsten Inert Gas (TIG) process. In the first part, a computation code under Fortran was elaborated to solve the equations resulting from the finite difference discretization of the heat equation, taking into account the liquid-solid phase change with the associated boundary conditions. In order to calculate the velocity field during welding, the Navier-Stokes equations in the melt zone were simplified and solved considering their stream-vorticity formulation. A mathematical model was developed to study the effect of the melted liquid movement on the weld pool. The evolution of the fraction volume of the liquid and the thermal fields promoted the determination of the molten zone (MZ) and the Heat Affected Zone (HAT) dimensions, which seems to be in good agreement with literature.

Keywords : Thermal and flow modeling, TIG welding, Heat affected zone, molten zone