Numerical modelling of an aluminium alloy welded by a TIG process and experimental validation

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Abstract : — recently, the interest of the heat transfer in fusion welding is needed to satisfy more and more industry requirements (such as in the aeronautic, automobile… etc). Considering the particularity of local fusion and adjacent zones, the welded joint is subjected to metallurgical transformation and thermal treatment at high temperature. So, they produce changes in the microstructure and in the mechanical properties, which increase the influence of risk zones in assembled structures.In this work, modelling of welding phenomena of 2017-T4 / 2024-T4 Aluminium alloy is presented. In order to study the thermal behaviour of welded joint obtained by the arc welding process TIG (Tungsten-Inert-Gas), and to determine the range of the risk zones in the weld bead. To model the heat source of welding we have used a bi-elliptic surface with Gaussian distribution function of the heat flow. The effect of radii of this heat source model is shown and their values are optimized. The heat equations governing the problem are resolved by finites elements method. The simulation allowed us to have the thermal field and temperature cycles at each point of plate. The behaviour of heat flux vectors is studied and discussed in this work. To test the efficiency of the model, a comparison with the experimental measurements is performed; the results indicate a good agreement.

Keywords : Aluminum alloy, Finite elements method, heat flux, TIG welding, Thermal cycles, ANSYS