Numerical modelling of the braze welded assembly of a copper coated with Inconel 601 and steel

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ABSTRACT

The numerical simulation of Magneto-Thermal processes rests on the modelling of the couplings between magnetic and thermal phenomena [1,2,3,4,5,6]. A 3D, nonlinear, magneto-thermal coupling finite element model for the study of a resistance welding of a ground electrode made of copper coated with Inconel 601, on a steel base is proposed. The approach is based on Maxwell electromagnetic equations, heat equation, and nonlinear constitutive equations. Separate 3D mesh divisions are developed for accurate current and thermal field analysis. The ground electrode is welded on the steel base using a current at a frequency of 5 KHz. However, the welded zone presents a poor mechanical behavior. To remedy to this problem, one solution is to optimize the welding sequence and process parameters such as the currents frequency using experimentation. But this solution is extremely expensive and time-consuming and finally, very few solutions can be experienced. Finite Element simulations can be used in this aim. A comprehensive analysis procedure has been developed to perform the incrementally coupled magnetic-thermal analysis to simulate the resistance welding. Advantages and drawbacks of the method are discussed.

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