Study the Influence of Gas Pressure on the Tensile Behavior of TIG Stainless Steel Sheets

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Abstract

This research work represents the study of the effect of using different gas pressures of argon on the tensile behavior of tungsten inert gas (TIG) welded stainless steel sheets type (304). Different ranges of gas pressures (13-15 Kgf/cm^2)and welding currents (80-100 Apm) were used to determine their influenceon the tensile mechanical properties (0.2% yield stress, ultimate tensile stress and elongation) of butt welded joints.Design of experiment (DOE) 'version 10' was used to establish the design matrix of experiments. Response surface methodology (RSM) technique was employed to obtain mathematical models for the three properties, which were analyzed by the analysis of variance (ANOVA) to verify statistically the adequacy of the resulted models. The resultant quadratic models with a confidence level of 95% revealed thatthe increase in both gas pressure and currentindividually results in a higher increase in the yield stress and elongation,and both were proportionated inversely,while their combined effect gave the lowest values.The gas pressure had a greater impact on the ultimate tensile stress than current. After numerical optimization, the maximum values of the mechanical properties were obtained with a maximum desirability value at the optimum values of gas pressure and current. Finally, confirmation tests were conducted at the optimum values of gas pressure and current to verify the validation of the maximum values of properties, and the error wasfound less than (4%) between the experimental and predicted results.

Keywords: TIG welding, Gas Pressure, Mechanical Properties, Design of Experiment, Response Surface Methodology, Numerical Optimization.