THE DETERMINATION OF OPTIMUM PARAMETERS FOR MULTIPLE PERFORMANCE CHARACTERISTICS IN PULSED GAS METAL ARC WELDING OF AISI 904 L SUPER AUSTENITIC STAINLESS STEEL USING GREY RELATIONAL ANALYSIS

P. MANAVALAN & S. RAVI
Department of Manufacturing Engineering, Annamalai University, Annamalai Nagar, India

ABSTRACT

Welding input parameters play a vital role in determining the quality of a weld joint. The quality of the joint can be defined in terms of mechanical properties and weld-bead geometry. Generally, all welding processes are employed with the aim of obtaining a welded joint with the desired characteristics. The purpose of this study is to propose a method to decide near optimal settings for the welding process parameters in pulsed gas metal arc welding (P-GMAW) of AISI 904L super austenitic stainless steel by using grey relational analysis. Grey relational analysis was applied to optimize the input parameters by considering multiple output variables simultaneously. The welds were performed on a sheet with a thickness of 5 mm and a filler wire of diameter of 1.2 mm and their levels of different process parameters were Peak Current (Ip), Pulse Time (tp), Pulse Frequency (f), background current (Ib) and welding speed (S) which were considered as input responses. The central composite rotatable design was used to carry out the experimental design and predict the effects of input and output responses. In this study, the output responses considered were bead width, tensile strength, % of elongation, impact strength and microhardness of the welds. The main objective of this work is to determine the P-GMAW process parameters to maximize the tensile strength, % of elongation, impact strength and microhardness and minimize the bead width of the processed joints. This study describes how to obtain near optimal welding conditions over a wide search space by conducting relatively a smaller number of experiments. ANOVA analysis was carried out to identify the significant factors affecting tensile strength, % of elongation, impact strength, microhardness and bead width and further to experimentally validate the optimized parameters. Further investigation was carried out to study the mechanical and metallurgical properties of the optimized parameter weld joints.

KEYWORDS: P-GMAW, Tensile Strength, Impact Strength, Microhardness, Weld Bead Width & Grey Relational Analysis

Received: Dec 01, 2018; Accepted: Dec 20, 2018; Published: Jan 08, 2019; Paper Id.: IJMPERD/FEB201930