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Design and Analysis Welding of Dissimilar Materials

Dr. S. Subbaraj[1], A. Prasad[2], S. Prabhu[3]
Principal[1], Department of Mechanical Engineering, T. J Institute of Technology, Chennai, TamilNadu, India
Assistant Professor[2], Department of Mechanical Engineering, T. J Institute of Technology, Chennai, TamilNadu, India
Assistant Professor[3], Department of Mechanical Engineering, T. J Institute of Technology, Chennai, TamilNadu, India

Abstract: *The welding of dissimilar materials, particularly between carbon steel and stainless steel, presents significant challenges due to differences in their thermal, mechanical, and metallurgical properties. This project focuses on the design and analytical investigation of welding processes used to join these two materials. The primary objective is to develop a reliable welding procedure that ensures structural integrity, minimizes metallurgical incompatibilities, and meets performance requirements. The study begins with a detailed review of the physical and chemical properties of carbon steel and stainless steel, highlighting the issues related to thermal expansion, carbide precipitation, and intermetallic compound formation. Various welding techniques such as TIG, MIG, and friction welding are evaluated based on their suitability for joining these dissimilar metals. Finite Element Analysis (FEA) is employed to simulate thermal distribution, stress generation, and deformation during the welding process. Experimental trials are conducted to validate the simulation results, with weld quality assessed through mechanical testing (tensile, hardness, impact) and metallographic analysis. The results reveal critical insights into optimal welding parameters, filler material selection, and post-weld heat treatment strategies. This study contributes to the advancement of dissimilar metal welding by offering a comprehensive framework for designing robust weld joints that enhance durability and performance in industrial applications..*

Keywords: *welding*