Review on Optimization of Friction Stir Welding Parameters to Join Dissimilar Aluminum Alloys AA6061, AA2024, AA7075 and Friction Stir Processing to Improve Joint Properties

Pradeep Kumar R S
Research Scholar, Department of Mechanical Engineering, J.S.S. Academy of Technical Education Bangalore, Karnataka, India

Dr. Anilkumar K S
Department of Mechanical Engineering, J.S.S. Academy of Technical Education Bangalore, Karnataka, India

Abstract

Friction Stir Welding (FSW) and Friction Stir Processing (FSP) are emerging solid-state joining and processing techniques that have gained significant attention in recent years. FSW is a novel welding process that uses a non-consumable rotating tool to join two workpieces without melting, while FSP is a variant of FSW that is used to modify the microstructure and properties of a material. This paper reviews the recent advancements in FSW and FSP, focusing on the optimization of process parameters, microstructure evolution, and mechanical properties of similar and dissimilar aluminum alloy joints. This study reveals that FSW and FSP are effective techniques for joining and processing aluminum alloys, including dissimilar combinations such as AA2024-AA7075, AA7075-AA6061, and AA2024-AA6061. The optimization of process parameters, including tool rotation speed, welding speed and tool design is crucial for achieving high-quality joints with superior mechanical properties. The microstructure evolution and mechanical properties of FSW and FSP joints are influenced by various factors, including tool design, process parameters, and material positioning. This study also highlights the importance of FSP in enhancing the corrosion resistance and wear resistance of aluminum alloys. The addition of reinforcement particles, such as SiC and BNp, has been shown to improve the microstructure and mechanical properties of FSP joints. The study concludes by identifying the current challenges and future research directions in FSW and FSP including the development of new tool materials and designs, optimization of process parameters, and exploration of new applications.

Keywords

Friction Stir Welding, Friction Stir Processing, Aluminum Alloys, Microstructure, Mechanical Properties, Corrosion Resistance.