

Friction Stir Welding of Dissimilar Metals

Narayan Sahadu Khemnagar^{1,2}, Yogesh Ramrao Gunjal^{1,3}, Vijay Shivaji Gadakh^{1,2}, and Amrut Shrikant Mulay⁴

¹Department of Mechanical Engineering, Dr. Vithalrao Vikhe Patil College of Engineering, Savitribai Phule Pune University, Ahmednagar, Maharashtra, India

²Department of Automation and Robotics Engineering, Amrutvahini College of Engineering, Savitribai Phule Pune University, Ahmednagar, Maharashtra, India

³Department of Mechanical Engineering, Amrutvahini College of Engineering, Savitribai Phule Pune University, Ahmednagar, Maharashtra, India

⁴Department of Mechanical Engineering, Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat, India

7.1 Introduction

The dissimilar material welding attracts the attention of many industries due to its technical and economic benefits, including the automobile. Researchers worldwide now acknowledge the recognized benefits of employing the solid-state welding technique as a promising solution for difficult-to-weld materials and additive manufacturing [1]. FSW is a superior joining method in contrast to traditional joining methods due to its energy efficiency, versatility, solid-state nature, and environment friendliness [2]. FSW, usually recognized as the most notable development in this subject, has revolutionized the joining of similar and dissimilar materials. The dissimilar materials using the FSW process can offer several benefits, including improved performance, weight reduction, cost reduction, and increased material availability. Joining two dissimilar metals is very much crucial in industrial applications.

Due to new environmental rules, the transport industries must strictly limit greenhouse gas emissions. The vehicle's structure can be made lighter as one method of reducing the emissions. Research-minded automotive industries are now aiming for lightweight materials to enhance fuel efficiencies. Al alloys with other alloys offer dominant strength assurance without losing a lightweight nature. In dissimilar metals, particularly lightweight metals, Al alloy in combination with steel is an advantage in the automotive and aerospace industries. This chapter begins with an Introduction, followed by applications of FSW in dissimilar material joining, as depicted in Section 7.2. Section 7.3 describes the issues related to dissimilar material joining. Section 4 elucidates the FSW of dissimilar material joining of Aluminum (Al) alloys, Al-Copper (Cu), Al-Titanium (Ti), and Al-Steel alloys. The recent developments in tool design and tool materials are explained in Section 7.5. The parameter optimization and common defects that

Friction Stir Welding and Processing: Fundamentals to Advancements, First Edition.

Edited by Sandeep Rathee, Manu Srivastava and J. Paulo Davim.

© 2024 John Wiley & Sons, Inc. Published 2024 by John Wiley & Sons, Inc.