Review of research progress on aluminum-magnesium dissimilar friction stir welding

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Abstract

The paper critically assesses the research progress towards aluminum-magnesium dissimilar friction stir welding (FSW). First, the theoretical requirements are explored through the understanding of joining mechanism and heat generation in aluminum-magnesium FSW. Next, the observed trends in microstructural characterization and mechanical properties are analyzed. Lastly, the effects of welding parameters and how it influences process variables and materials responses are discussed in detail, and several suggestions are made based on these discussions.

Keywords

Dissimilar welding; Aluminum; Aluminium; Magnesium; Friction stir welding; Joining; Intermetallic compound; Mechanical property; Microstructural property.

INTRODUCTION

Welding has always been a prominent enabling technology in various industrial fields due to its superior advantages compared to other joining techniques such as adhesive and mechanical fasteners. The primary requirements of any joint design will require satisfactory mechanical properties which are ideally comparable to the base materials. Therefore, improving joint quality has been addressed through research into new welding methods, including friction stir welding (FSW) [1], laser welding [2], [3] as well as hybrid welding techniques [4]–[7]. The majority of commercial alloys have been demonstrated to be weldable by a variety of technologies [8], however many challenges have emerged recently when encountering dissimilar metal combinations which are more frequently demanded in lightweight multi-material designs [9].

This has motivated a significant portion of research towards dissimilar material welding. Dissimilarity in welding can be considered from many aspects and can be categorized in the order