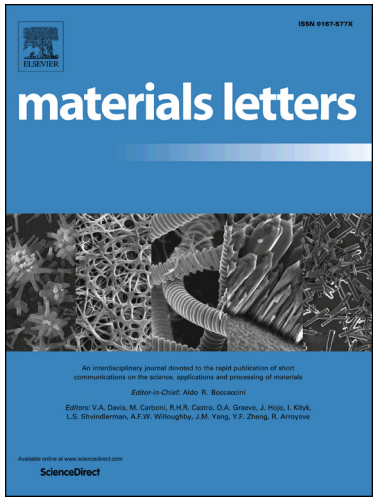

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PII: S0167-577X(17)30732-2
DOI: http://dx.doi.org/10.1016/j.matlet.2017.05.011
Reference: MLBLUE 22585

To appear in: *Materials Letters*

Received Date: 13 February 2017
Revised Date: 9 April 2017
Accepted Date: 1 May 2017

Please cite this article as: S. Ji, X. Meng, Z. Liu, R. Huang, Z. Li, Dissimilar friction stir welding of 6061 aluminum alloy and AZ31 magnesium alloy assisted with ultrasonic, *Materials Letters* (2017), doi: http://dx.doi.org/10.1016/j.matlet.2017.05.011

Dissimilar friction stir welding of 6061 aluminum alloy and AZ31 magnesium alloy assisted with ultrasonic

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Abstract: Both simple interface joining and continuous intermetallic compounds (IMCs) layer formed at the interface of Al/Mg alloys during friction stir welding (FSW) deteriorates mechanical property. Based on stationary shoulder, ultrasonic was employed to assist FSW of 6061-T6 and AZ31B alloys to increase interface joining length and mixture degree of Al/Mg alloys at nugget zone (NZ). Sound joint with smooth surface is obtained, resulting from the combined effect of stationary shoulder and ultrasonic. Ultrasonic are beneficial to increasing material flow, interface joining length and mixture degree of Al/Mg alloys, improving mechanical interlocking. The tensile strength and elongation of joint with ultrasonic reach 120MPa and 1.5%, which are higher than that without ultrasonic. Additionally, local fracture surface morphology consists of some dimples, presenting mixed fracture containing brittle and ductile fractures.

Keywords: Friction stir welding; Metals and alloys; Intermetallic alloys and compounds; Stationary shoulder; Ultrasonic; Ductile fracture.

1 Introduction

Friction stir welding (FSW), as a solid state welding technique, can avoid crack, pore and slag inclusion associated with fusion welding, which has potential to join dissimilar materials [1-3]. However, for welding joint of Al/Mg alloys, hard and brittle intermetallic compounds (IMCs) inevitably form in nugget zone (NZ) and become the location of crack propagation path, deteriorating mechanical property [4].

In fact, distribution and size of IMCs significantly influence Al/Mg joint quality. Mofid et al. [5,6] reported that tensile fracture easily occurred at the location with continuous IMCs. Therefore, it is inferred that discontinuous and even dispersive