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FEASIBILITY STUDY ON JOINING DISSIMILAR ALUMINUM ALLOYS AA6061 AND AA7075 BY TUNGSTEN INERT GAS (TIG)

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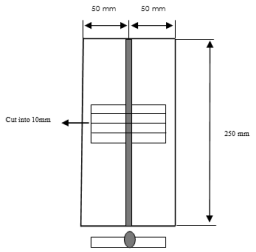
Graphical abstract



Abstract

The aim of this paper is to study the feasibility of welding dissimilar aluminum alloys AA6061 and AA7075 using different types of filler metals which are ER4043 and ER5356. The tungsten inert gas (TIG) welding method was used to butt joint these alloys. The effect of ER4043 (Si-rich) and ER5356 (Mg-rich) on weldability of the joint were studied through visual appearance, microstructures and hardness. It was found that, welding using filler ER5356 produced deeper penetration compared to filler ER4043. The depth of penetration obtained using filler ER5356 was 1.74 mm, while only 0.9 mm of penetration was obtained using ER4043. Microstructures at different zones of dissimilar TIG joints such as the fusion zone (FZ), the partially melted zone (PMZ) and the heat affected zone (HAZ) were identified. The grain size at FZ from filler ER5356 samples was finer compared to filler ER4043 which was 11.4 µm and 19.5 µm, respectively. The average hardness welding value of filler ER5356 samples was higher compared to filler ER4043 samples, which were 100HV and 86HV, respectively at HAZ of AA 6061, 110HV and 88HV, respectively at FZ, while 113HV and 85HV, respectively at HAZ of AA 7075. It can be concluded that TIG welding using the ER5356 filler yields better joint compared to ER4043.

Keywords: Dissimilar welding, AA6061, AA7075, TIG welding

Abstrak

Tujuan kertas ini adalah untuk mengkaji kebolehlaksanaan kimpalan aluminium aloi yang berbeza AA6061 dan AA7075 menggunakan logam pengisi jenis yang berlainan iaitu ER4043 dan ER5356. Kaedah kimpalan Tungsten inert gas (TIG) dengan sambungan kaedah temu telah digunakan untuk menyambung aloi ini. Kesan ER4043 (kaya-Si) dan ER5356 (kaya-Mg) pada kebolehkimpalan sendi telah dikaji dengan penampilan visual, mikrostruktur dan kekerasan. Ia telah didapati bahawa, kimpalan dengan menggunakan pengisi ER5356 menghasilkan penembusan yang lebih mendalam berbanding daripada menggunakan pengisi ER4043. Kedalaman penembusan diperolehi dengan menggunakan pengisi ER5356 adalah 1.74 mm, manakala hanya 0.9 mm penembusan telah diperolehi dengan menggunakan ER4043. Mikrostruktur di zon yang berbeza daripada TIG sendi berbeza seperti zon pelakuran (FZ), zon separa cair (PMZ) dan zon terkesan haba (HAZ) telah dikenal pasti. Saiz bijian pada FZ dengan menggunakan pengisi ER5356 adalah lebih halus berbanding dengan kimpalan menggunakan pengisi ER4043 iaitu masing-masing dengan 11.43µm dan 19.51µm. Purata kimpalan nilai kekerasan dengan menggunakan pengisi ER5356 berbanding dengan menggunakan pengisi ER4043 iaitu pada kawasan HAZ 6061 masing-masing adalah 100HV dan 86HV, manakala kawasan FZ masing-masing adalah dengan 10HV dan 88HV dan pada kawasan HAZ 7075 masing-masing adalah 113HV dan 85HV. Secara kesimpulannya, hasil menggunakan kimpalan TIG menggunakan pengisi ER5356 adalah lebih baik berbanding ER4043.

Kata kunci: Kimpalan berbeza, AA6061, AA7075, Kimpalan TIG