The Effect of Pulse Current on Mechanical Properties of Weld Bead for Ultra-Light Mg-Li Alloy

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ABSTRACT

The " Green concepts " are highly emphasized in the worldwide. Therefore, the light-weight and recyclable materials will be the dominated material in the new century. Among them, magnesium alloy and aluminum alloy are the best representative metals. Up to now, Mg alloys are not only used in 3C products but also in many other fields. Especially, they are suitable for weight saving constructions in the vehicle, motorcycle and aerospace industry. The magnesium-lithium (Mg-Li) alloy owns smaller specific density (~1.35 g/cm3) and higher elongation (~50%) behaviors than other types of magnesium (Mg, 1.80 g/cm3) alloy. It is good for the low temperature formability. However, only very few welding papers relating to Mg-Li alloy were reported. In this study, we selected the most popular welding machine in industry, gas tungsten arc welding. This intention was discover the effects of microstructure and mechanical properties of welds by changing the frequency of pulsing current (0, 3, 6, 9, 18Hz). To understand the weldability of LZ70 and LZ90 alloys with different welding processes. From the Mg-Li binary phase diagram, LZ70 and LZ90 alloys belong to two-phase system. By applying the pulsing current, the microstructure morphology and distribution in different frequency welds are changed. But the major structures of welds were still in α and β dual phase. From the mechanical properties shown that the micro-hardness and ultimate tensile strength for LZ70 welds are superior to LZ90 alloy, but the elongation and toughness is relatively better in LZ90 welds. Analyzing the mechanical properties with XRD results showed that changing the α-Mg phase content will influence the tensile strength directly. Further observation the fracture surface found that the fracture modes of weld were mainly intergranular on both LZ70 and LZ90 welds. The distribution of dimple structure in LZ70 welds is quite similar, so the elongation is close. However, the fracture surface in 0 and 9 Hz LZ90 welds appear dense-folded dimple structure with more roughing surface. But in 3 Hz weld, the fracture surface is relatively flat and do not found dimple structure, so the behavior of elongation and toughness is worse than other frequency welds. Hopefully, the result of this study was able to accumulate the knowledge of Mg-Li alloy welding techniques and to benefit of the traditional metal working industries, and expand the applications of magnesium lithium alloy.

Keywords : Magnesium Lithium Alloy, Gas Tungsten Arc Welding,Pulsing Current, Mechanical Properties, Dimple Structure

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