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Abstract
This study includes two parts. In part one, AA6022-T4E29 aluminum alloy sheet parent metal of 0%, 3%, and 6% pre-strain together with Nd : YAG laser welded AA6022-T4E29 weldment of 0% and 3% pre-strain were heat treated to simulate the Paint Bake Cycling (PBC) or 175℃/1000 min. Transmission electron microscope was utilized to analyze the characteristics of precipitates and microstructure after pre-strain and heat treatment. Subsequently, the effects of precipitates and microstructure variation on the mechanical properties of parent metal and weldment were discussed. In part two, the parent metal is proceeded one of three kinds of treated processes which are T4E29 + pre-strain + pre-aging + PBC (TPSPAP), solution treated (at 560℃/20min) + T4(8days) + pre-strain + pre-aging + PBC (STPSPAP), and T4E29 + pre-aging + pre-strain +PBC (TPAPSP) to investigate the difference between mechanism properties and the best aging treated time. The level of the pre-strain and pre-aging time are 0%, 3%, 6% and 100min, 300min, 500min, 1000min, respectively. The results of part one, the yield strength of the parent metal both with the PBC process and without the heat treatment will increase with the increasing pre-strain accordingly. After the heat treatment with 175℃/ 1000 min, because of the β" phase precipitated in the matrix, it makes both the yield strength and the hardness are higher than the specimen both with and without the PBC. While the pre-strain increases continuously, the β" phase transformed into coarser and over aged Q' phase to reduce hardness and strength. In the weldment, because of the dislocation increased in the weld metal, both with the PBC process and without the heat treatment, the yield strength increases as pre-strain increases. After the PBC process, because of the precipitation produced, the tensile strength and the yield strength are higher than the weldment without the heat treatment. Further, the strength of weldment with the PBC process is higher than the strength of weldment without the heat treatment. However, because after the heat treatment with 175℃/1000 min, the β" phase were produced, the strength is higher than the former two series of specimens and increases with increasing pre-strain. Part two's results indicate the specimens treated under TPAPSP process have the highest tensile strength or the yield strength, while that treated under STPSPAP process have the lowest. The highest of the tensile strength in TPAPSP specimens is at the pre-aging 1000 min, while that in the processing of TPSPAP and STPSPAP are separately at pre-aging 0 min and 300min, and the yield strength of both series specimens are at the pre-aging 500min.
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