

틈새 형상에 따른 이종재질 스테인리스강 레이저 용접부의 강도특성

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Effects of Gap Design on Strength Properties of Stainless Steel Dissimilar Weld Using a Pulsed Nd:YAG Laser

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Abstract

Experimental investigations are performed to find out that the properties of mechanical strength of Nd:YAG laser-welded joints with different gap widths between the dissimilar steel such as AISI 304(austenitic stainless steel) and AISI 630(precipitation-hardening stainless steel). The welded structure of missile wing have a shape of pocket to optimize the weight of the structure consisting of thin skin(AISI 304) and thick skeleton(AISI 630).

The tensile tests are accomplished with the MTS-model 810 machine for welded specimens of dissimilar material with gap. Also, fatigue test are performed to estimate the fatigue strength for the pulsed Nd:YAG laser-welded specimens with gap. The residual stresses at the surface of the weldments which is composed of welded specimen and the missile wing are measured by instrumented indentation technique.

From the results of the tests, the tensile strengths, yield stress and modulus of elasticity are very similar for two kinds of different gap sizes and the fatigue strengths are almost the same for two gap conditions with relatively high fatigue loading conditions. According to the results of the experiments, fracture is generated at lower fatigue strength than AISI 304 base metal, and this reason is analyzed due to the residual stress produced during welding. The results of the test are showed that the position of the fracture is close to a part of fracture by tensile strength test load under a test of low cycle fatigue and to a part of weld pool under high cycle fatigue. That is, the position of the fracture is showed to be getting moved from pure base metal to a part of weld pool when the fatigue load is reduced. Finally, the residual stress distributions of the wing are the same trend for five measured positions, such as a high tensile residual stresses measured in AISI 630 region and a relatively low residual stresses happened in AISI 304.

Key Words : Tensile strength, Residual Stress, Pulsed Nd:YAG laser, Fatigue strength, AISI 304, AISI 630