

OP 320

The effect of weld bead geometry on the microstructure and mechanical properties of 7050-T7451 aluminum alloy by laser arc hybrid welding

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High quality joints of 7050-T7451 aluminum alloy with different weld bead geometry were fabricated by adjusting the magnitude of the laser power during the laser arc hybrid welding process, and the relationship among weld bead geometry, microstructure and mechanical properties of the welded joints was systematically analyzed. With the increase of laser power, the cross-section shape of the joints changes from Y-type to U-type, meanwhile, the surface width of the weld bead increases slowly, while the back width increases rapidly, causing a quick increment of the back width to surface width ratio (R_w), a typical representative of weld bead geometry. The grain size of equiaxed dendrite in weld zone increases and the equiaxed fine grain zone between the columnar grain zone and heat affected zone becomes wider as the R_w increases. The weld seam is the weak area of the welded joints and the increment of R_w results in an increase in the tensile strength of the joints until a peak value reaches with a R_w of 0.83, after which it declines rapidly. It is of great significance to guide the rapid evaluation of weld quality in the production process through the macroscopic morphology parameters of the weld seam.