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Influence of processing parameters on the characteristics of stainless steel/copper laser welding

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Abstract

The microstructures and mechanical property of stainless steel/copper laser welding were investigated by controlling the processing parameters of welding speed and laser power as well as the offset and incline angle of the laser beam in the direction of the stainless steel. The joining mode could be controllably transformed to welding-brazing from fusion welding. The welding-brazing mode joins liquid stainless steel to solid copper, whereas the fusion zone mode joins stainless steel and copper by melting and mixing both metals. Offsetting and inclining the laser beam in the direction of the stainless steel can effectively suppress the melting of the copper and ensure the joining occurs via welding-brazing. The grains of heat-affected zone (HAZ) on the side of the copper grow significantly. Liquid separation reactions induce spherical particles with copper and some bigger spherical particles with copper contained smaller spherical particles with stainless steel. The highest tensile strength of the joint reaches 260 MPa. The joint exhibited three typical modes of fracture: the interface, the heat affected zone (HAZ) and the fusion zone, depended on the processing parameters that were used. The tensile strength is weakly dependent on melting of the copper, but melting of the copper induces a decrease in the joint toughness.

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