

Topology optimization of wire in gas tungsten arc welding

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Abstract

We performed the topology optimization of wire for increasing the efficiency of gas tungsten arc welding (GTAW). GTAW is one of the welding methods using the thermal plasma and allowing for the stronger and higher quality welds. For the increasing the performance, the high heat should be applied to work piece. Therefore it is important to shoot the plasma which helps the transfer the heat at high density. The force that the greatest effects on the behavior of the plasma is the Lorentz force which is generated by the electromagnetic fields. We added to the wire on the welding system to increase the Lorentz force. And topology optimization of wire was performed. For calculating electromagnetic fields, we used commercial software 'COMSOL' which based on Finite Element Method. And we formulate optimization problem for designing the wire, maximizing the Lorentz force. We presented the wire's geometry.

Keywords:

Plasma, Gas tungsten arc welding, Electromagnetic fields, Finite element method, Topology optimization,