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Simulation of Laser Welding by Particle Method

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SUMMARY

Laser welding is one of the promising welding methods for metals and has been expected to expand new joining and welding fields. Distortion during laser welding is much smaller than conventional welding with arc, because laser beam can produce ideal penetration in several metals with smaller heat. Moreover, high welding speed and full automatic operation are possible by in laser welding.

On the other hand, it is difficult to control laser welding due to multiphase of solid, liquid, gas and plasma in laser processing. To make up an appropriate joining condition without welding defects, a variety of trials and errors has been made in manufacturing. Clarification of its rapid and complicated phenomena is important to extract latent potential of laser welding.

In this study, the fundamental process of melting metal by laser was simulated on the basis of particle method. In the conventional method with using FE mesh, it is difficult to simulate a complicated subject which has moving boundary face largely such as welding surface. This new simulation using particle method can reveal large change of molten surface, which is necessary for high quality welding.

The developed simulation method calculated some processes of laser exposure or melting with deep penetration. The complex mechanics of melting and evaporation of metal, streaming motion of liquid and making penetration shape were cleared in comparison with the results of high speed observation or X ray in-suite observation of laser welding. Therefore, the usability or effectiveness of particle method for laser welding process is discussed.