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Development of Ultra Lightweight Parts Using Hot Stamping and Laser Welded Patchwork Technology (2nd Report)

- On Study of Laser Welding Pattern and Performance Evaluation Using Small Specimens -

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Hot stamping patchwork technology is gathering attention because it can achieve both crashworthiness performance and lightweight by locally increasing strength or thickness. In this study, laser welding with a high reinforcing effect was used for the joining between main blank and patchwork blank, the effect of welding pattern on the reinforcing effect and solutions against the relative sliding in joint areas during forming process were investigated by using a small test piece and a hat-shaped part.

In order to evaluate the hot stamping hardenability of the patchwork plate used in this study, Assuming that uniform quenching is difficult, evaluation was performed using a mold that cools only one side. It was confirmed that even a part with a slit width of 20 mm, which is quenched on one side, was quenched without any problems and had the required hardness.

Next, by evaluating small test pieces, we confirmed the reinforcing effect of straight laser welding, the effect of suppressing displacement of joints during bending by straight laser welding, and the reinforcing effect of geometric laser patterns. From the test results, it was confirmed that welding in the longitudinal direction is highly effective in terms of reinforcing effect, and welding in the width direction is effective in preventing weld bead displacement during bending(Fig. 1, Fig. 2).

We created a hat-shaped test piece similar to that of an automobile part with laser welding patchwork using a welding pattern created from the knowledge obtained from the small test piece, and confirm the reinforcement effect by 4-point bending(Fig. 3).As shown in Fig. 4, the results confirmed that the laser-welded patchwork had a higher reinforcing effect than the current spot-welded patchwork, and the difference was about 6.7%.

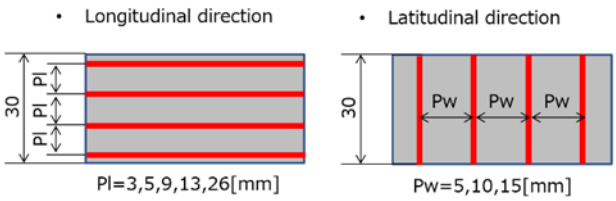

Fig. 1 Small test piece, straight laser welding specifications

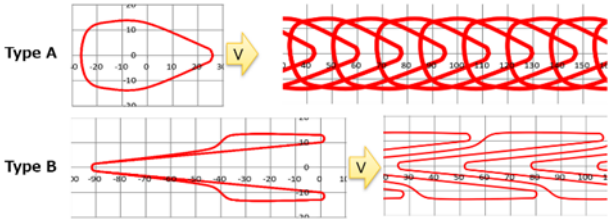

Fig. 3 Various laser welding patterns obtained by moving repeated laser pattern

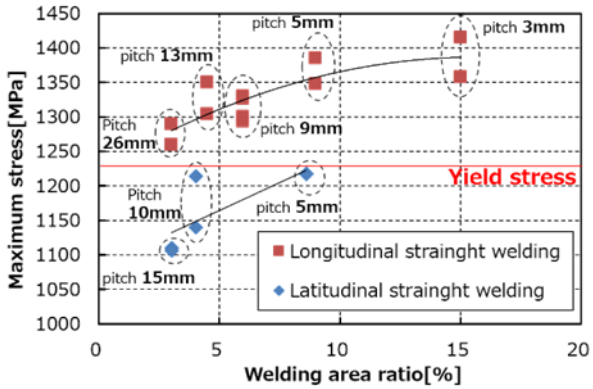

Fig. 2 Small test piece crush test result (straight laser welding)

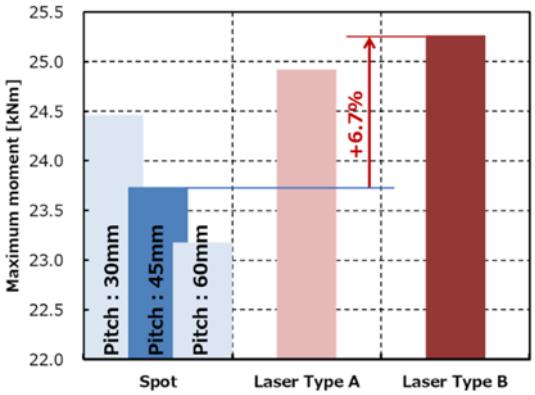

Fig. 4 4-point bending result