INVESTIGATION ON THE WELD GEOMETRY OF FIBER ASER DISSIMILAR WELDED OF BORON STEEL FOR TWB APPLICATION

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ABSTRACT
Pulse wave (PW) mode is a good replacement for continuous wave (CW) mode in tailored welded blank (TWB) application in automotive industry. Due to an ability to produce higher peak power in low power laser pulse mode which is related to performance process parameter, the weld penetration and quality can be achieve similar to utilization of high power laser CW mode. However, the effect of PW mode laser welding parameter together with weldability against weld geometry of specific materials is rarely done before. Moreover, based on demand of boron steel requirement in TWB application, this research investigated the effect of laser welding parameter on mechanical properties of boron steel. The weldability analysis also carried out based on weld geometry produced. low power fiber laser welding has been chosen in this research work and the welding parameters are optimized by response surface method (RSM) using Box-Behnken design (BBD) method in order to provide the most suitable design of experiment (DOE) to weld this boron steel sheets. The laser parameter involved were peak power (PP), welding speed (WS) and focal position (FP). To discuss the relationship between the tensile strength and microstructure, welded samples are cut at the stable weld's cross section and prepared for the macro and microstructure observation. Metallurgical analysis was conducted using an optical microscope. It was found that the highest tensile strength was 445.7 MPa with fracture located at the base metal. For microstructure, finer grain produced at the center of fusion zone (FZ) compared to the FZ near the transition line which produced coarser and medium grain. Weldability analysis result found that the parameter combination must be sufficient for adequate penetration which is required in order to achieve high strength of joint. Otherwise the fracture will occur at weld area and reduce tensile strength result. In conclusion, the boron steel was successfully welded by using low power fibre laser with PW mode in butt joint configuration. The sufficient penetration the most influence characteristic to produce higher strength of welded joint without hardness degradation.

Keywords: Low power laser; fiber laser; boron steel; TWB; dissimilar thickness; weld geometry; microstructure.