Defect Identification During Pulse Mode Laser Welding Process Through the Pattern Recognition Analysis of the Acquired Sound Frequency Spectrum

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Abstract Problems on laser weld quality still remain as vital issue even though the process was done with optimized condition which results the demand on robust monitoring method during the process. Until recently, many methods have been explored and air-borne acoustic are among of methods that have been proven to be able to detect the presence of defect. However, despite detection, it is essential if the type of defect could be identified as it gives different severity level to the development of failure. This work presents the identification of defect during pulse mode laser welding through the analysis of sound. In achieving the goal of this study, bead on plate weld have been done onto the 22MnB5 boron steel plate repeatedly based on 3 different set of experiment with the variation in the level of parameters. Simultaneously, time-series sound signal was acquired along the process before it was converted into frequency spectrum before further analysis. According to the result, it was recorded that the variation of parameters level in pulse mode laser welding process lead to the presence of porosity and crack. Relatively, the trend of sound frequency spectrum were also significantly changes its trend in respond to the parameters level variation. It was discovered that the dominant frequency for the signals acquired from the process which produce good quality weld, porosity and crack recorded the same range which was between 5 to 7 kHz. Uniquely, the existence of porosity could be identified by the occurrence of peak at around 9 kHz while the presence of crack could be recognized by the occurrence of peak at 8 kHz and 11 kHz. This trend was proven to be consistent in repeated experiment according to the result from principal component analysis. Based from the result in this study, it could be conclude that the identification of defect could be done by the analysis of the acquired sound during the process. Significantly, this would expand the ability

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