Journal of Manufacturing Processes

Volume 34, Issue 2, 2018, Pages 566-578

Friction stir welding process improvement through coupling an optimizationprocedure and three-dimensional transient heat transfer numerical analysis

Moustafa BOUKRAA, Nadhir Lebaal, Amina MATAOUI, Abdelhakim Settar, Mouloud Aissani, Nacer Tala-Ighil

Abstract: The present study deals with the improvement of the Friction Stir Welding process, through the prediction of theoptimal operating conditions, necessary for welding typical Aluminum-Lithium alloy material AA2195-T8. Anoptimization strategy coupled with 3D transient heat transfer computation were used to improve the FSWprocess parameters such as welding velocity, tool rotation velocity, tool diameter and applied force. The optimizationprocedure is based on three criteria: the control of the maximum temperature during FSW; the minimizationof the Heat Affected Zone (HAZ) length and finally the reduction of the total welding energy. Theobtained optimal parameters have given an ideal welding temperature in the workpiece, thereby ensuring goodwelding quality, gain in energy consumption and decrease both the welding time and the HAZ length.

Keywords : Friction Stir Welding (FSW), Heat transfer, finite volume method, SQP algorithm optimization method