

An Integrated Approach for Optimal Selection of Machining Parameters in Laser Micro-Machining Process

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Abstract : In the existent analysis, laser micro machining (LMM) of Silicon carbide (SiCp) reinforced Aluminum 7075 Metal Matrix Composite (Al7075/SiCp MMC) was studied. While machining, Because of the intense heat generated, A layer gets formed on the work piece surface which is called recast layer and this layer is detrimental to the surface quality of the component. The recast layer needs to be as small as possible for precise applications. Therefore, The height of recast layer and the depth of groove which are conflicting in nature were considered as the significant manufacturing criteria, Which determines the pursuit of a machining process obtained in LMM of Al7075/10%SiCp composite. The present work formulates the depth of groove and height of recast layer in relation to the machining parameters using the Response Surface Methodology (RSM) and correspondingly, The formulated mathematical models were put to use for optimization. Since the effect of machining parameters on the depth of groove and height of recast layer was contradictory, The problem was explicated as a multi objective optimization problem. Moreover, An evolutionary Non-dominated sorting genetic algorithm (NSGA-II) was employed to optimize the model established by RSM. Subsequently this algorithm was also adapted to achieve the Pareto optimal set of solutions that provide a detailed illustration for making the optimal solutions. Eventually experiments were conducted to affirm the results obtained from RSM and NSGA-II.

Keywords : Laser Micro Machining (LMM), depth of groove, Height of recast layer, Response Surface Methodology (RSM), non-dominated sorting genetic algorithm

Conference Title : ICMSE 2014 : International Conference on Manufacturing Systems Engineering

Conference Location : Venice, Italy

Conference Dates : November 14-15, 2014