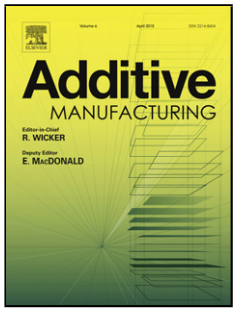

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Optimization of process parameters for reducing warpage in selected laser sintering of polymer parts

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Abstract

Selective Laser Sintering (SLS) is a rapidly growing additive manufacturing process, because it has the capacity to build parts from a variety of materials. However, the dimensional accuracy of the fabricated parts in this process is dependent on the ability to control phenomena such as warpage and shrinkage. This research presents an optimization algorithm to find the best processing parameters for minimizing warpage. The finite element method was used to simulate the sintering of a layer of polymer powder, and the warpage of the layer was calculated. The numerical model was verified through comparison with experimental results. A back-propagation neural network was used to formulate the mapping between the design variables and the objective function. Results of 40 simulation cases with various input parameters such as scanning pattern and speed, laser power, surrounding temperature, and layer thickness were used to train and test the neutral network. Finally, The Genetic Algorithm was employed to optimize the objective function, and the influence of parameters on warpage was investigated.

Keywords: Selected laser sintering; warpage, optimization, FEM

INTRODUCTION

Additive manufacturing (AM) is a fast growing technology in industry. In AM, parts are fabricated directly from their CAD models. Several additive manufacturing processes have been introduced in the last two decades. These processes are often categorized based on the initial state of material (solid, liquid or powder). Powder based processes have received