

Rapid Tooling by Laminated Object Manufacturing of Metal Foil

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Abstract. The technology of Laminated Object Manufacturing (LOM) is not very new. For hundreds of years wooden parts are built by stacking layers together. Nowadays also paper, plastic, ceramic composite and metal sheets are treated in layers.

For the manufacture of prototypes and especially technical tools, e. g. moulds for gravity casting, die casting or injection molding, out of metallic foil however the low self stiffness of this material is a great challenge. In this case it is useful to produce the parts in a two step process. The first sub-process is the stacking of the layers, which can be realised by laser beam spot welding to determine the position of the layer in combination with generating the defined contour by a laser beam cutting process. This procedure is done in a fully automated machine where the CAD-file of the desired part and the building parameters like the laser parameters and the cutting velocity are needed as input. However the stability of the produced green part is insufficient for most kind of application. Hence, a second sub-process to enhance the mechanical properties of the part is necessary. This can for example be realised by high temperature soldering or by diffusion welding in a furnace with inert gas or vacuum. During these kinds of joining processes the green part is homogeneously pressed with the help of a powder bed and at the same time it is tempered for a defined term.

In this paper the principle of sheet metal LOM is described as well as the process chain of Laminated Object Manufacturing of metal foil. For each sub-process of metal foil LOM the results of the experimental work for qualifying and optimizing the sub-process are shown. Finally some examples of possible applications especially in the field of Rapid Tooling and Rapid Manufacturing are discussed.