

Electroforming of 3D Digital Light Processing Printed Sculptures Used as a Low Cost Option for Microcasting

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Abstract : In this work, two ways of creating small-sized metal sculptures are proposed: the first by means of microcasting and the second by electroforming from models printed in 3D using an FDM (Fused Deposition Modeling) printer or using a DLP (Digital Light Processing) printer. It is viable to replace the wax in the processes of the artistic foundry with 3D printed objects. In this technique, the digital models are manufactured with resin using a low-cost 3D FDM printer in polylactic acid (PLA). This material is used, because its properties make it a viable substitute to wax, within the processes of artistic casting with the technique of lost wax through Ceramic Shell casting. This technique consists of covering a sculpture of wax or in this case PLA with several layers of thermoresistant material. This material is heated to melt the PLA, obtaining an empty mold that is later filled with the molten metal. It is verified that the PLA models reduce the cost and time compared with the hand modeling of the wax. In addition, one can manufacture parts with 3D printing that are not possible to create with manual techniques. However, the sculptures created with this technique have a size limit. The problem is that when printed pieces with PLA are very small, they lose detail, and the laminar texture hides the shape of the piece. DLP type printer allows obtaining more detailed and smaller pieces than the FDM. Such small models are quite difficult and complex to melt using the lost wax technique of Ceramic Shell casting. But, as an alternative, there are microcasting and electroforming, which are specialized in creating small metal pieces such as jewelry ones. The microcasting is a variant of the lost wax that consists of introducing the model in a cylinder in which the refractory material is also poured. The molds are heated in an oven to melt the model and cook them. Finally, the metal is poured into the still hot cylinders that rotate in a machine at high speed to properly distribute all the metal. Because microcasting requires expensive material and machinery to melt a piece of metal, electroforming is an alternative for this process. The electroforming uses models in different materials; for this study, micro-sculptures printed in 3D are used. These are subjected to an electroforming bath that covers the pieces with a very thin layer of metal. This work will investigate the recommended size to use 3D printers, both with PLA and resin and first tests are being done to validate use the electroforming process of microsculptures, which are printed in resin using a DLP printer.

Keywords : sculptures, DLP 3D printer, microcasting, electroforming, fused deposition modeling

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