ALPHASENSE DLP/LCD/SLA CASTABLE RESIN USER INSTRUCTIONS

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INTRODUCTION

ALPHASENSE DLP/SLA/LCD castable resin is a broad- band photocurable polymer system that contain monomers, photoinitiators and other additives. Upon light exposure, the photoinitiators generate radicals which promotes the polymerization reactions. The resin product can be cured with typical light sources found in common resin- based 3D printers (e.g. light bulbs and UV LEDs in DLP, and SLA/LCD printers, respectively). The resin is photocurable with UV wavelengths up to 420 nm. It is compatible with all the printing resolutions from 25 to 200 microns. Fast curing, complete burnout and virtually no residues are three major features of this product.

USAGE

- **3D PRINTING**

The most important parameter to fabricate a 3D model is the exposure time, which is mainly dependent on the following three factors: light intensity, the layer thickness and the cross- section area of the model (if a **DLP source/printer** is used). A relatively shorter exposure time can be used for a larger model (e.g. a denture), while longer exposure time is needed for smaller models, such as a jewelry/ring due to their different cross sectional areas. The following parameters are recommended for those two types of models for a layer thickness of 100 microns **with a DLP printer, such as those from EnvisionTec and B9Creation**.

Jewelry/ring: 20 seconds for the first 3 layers and 12 seconds for subsequent layers;

Denture: 15 seconds for the first 3 layers and 10 seconds for subsequent layers.

A settling time of 2-5 seconds is recommended for each layer.

For users with **LCD-type of printers, such as Anycubic Photon**, **ELEGOO MARS, Longer Orange, Phrozen Shuffle**, etc., the following baseline parameters are recommended. Please note that certain printers (e.g. Longer Orange) have different units (i.e. millisecond instead of s). Therefore, the user will need to input right numbers in those settings to account for the unit differences.

- Layer thickness: 0.05mm
- Bottom Layer Exposure: 100 s
- Bottom Layer Number: 10
- Normal Layer Exposure: 18 s
- Light-off Delay: 1 s
- Bottom light-off delay: 1s

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Novice users may mistaken the bottom layers as the first few layers of the 3D model. Those layers, however, are the base layers/blanket, on which subsequent support and 3D model will be based.

If a different layer resolution is desired, the user can vary the normal layer exposure while keeping the remaining parameters intact. ***It is crucial to use a relatively long bottom exposure time (80 to 100 seconds) and large number of bottom layers to ensure good plate adhesion. Otherwise, the resin may be insufficiently attached to the buildplate and tend to stick with the film on the resin vat.***

Another important factor is the support density. If Chitubox is used as the slicing software, heavy supports should be used: Heavy supports/larger pillars are ***mandatory*** to support larger models.

Please note that the above- mentioned parameters are the baseline parameters. The user is responsible to fine tune these parameters to fit his/her applications. Particularly, if the user needs to print a small model with many intricate structures, longer normal layer exposure time should be used.

For users with SLA printers, such as Formlab printers, our resin is compatible with all the default settings with layer resolution spanning from 25 to 200 micrometers.

- **POST-PROCESSINIG**

Our product allows easy removal of resin residues by rinsing the printed parts in warm water. Agitation should be used to ensure complete removal of the resin residue on the model surface. The water temperature needs to be in the range from 40 to 50 ^{o}C. For complete removal of uncured resin, the parts need to be rinsed for 1-2 minutes. The cured parts should have the needed strength for casting, and post-curing with a UV lamp is not mandatory. But if the user decides to use post-curing, he/she should put the rinsed/washed models in warm water (i.e. 50 ^{o}C) during post curing. An sample UV post-curing process involves light curing under 365nm, 40-W UV lamp for 30 minutes. ***The parts need to be completely air dried before they can be used for casting***.

- **CASTING**

Traditional "lost-wax" casting method needs to be followed for the fabrication of jewelries and dental components. The user needs to attach the printed model onto a wax tree. Relatively large sprues and button should be used to ensure smooth metal flow during the subsequent metal pouring/casting. The user needs to be embed the 3D models in a Gypsum-bonded or Phosphate- bonded investment material. If possible, phosphate bonded materials are preferred as it offers better strength and high-temperature stability. **For gypsum-bonded investment, one may need to mix 1 to 1.5% boric acid to the investment to enhance its mechanical strength. Additionally, vacuum should be applied during the investment mixing and after pouring/molding to drive out all the air bubbles. Furthermore, the mold should be hold in air for at least 3 hours before resin burnout. It is important to follow all these steps to ensure good surface quality of the resultant cast.**

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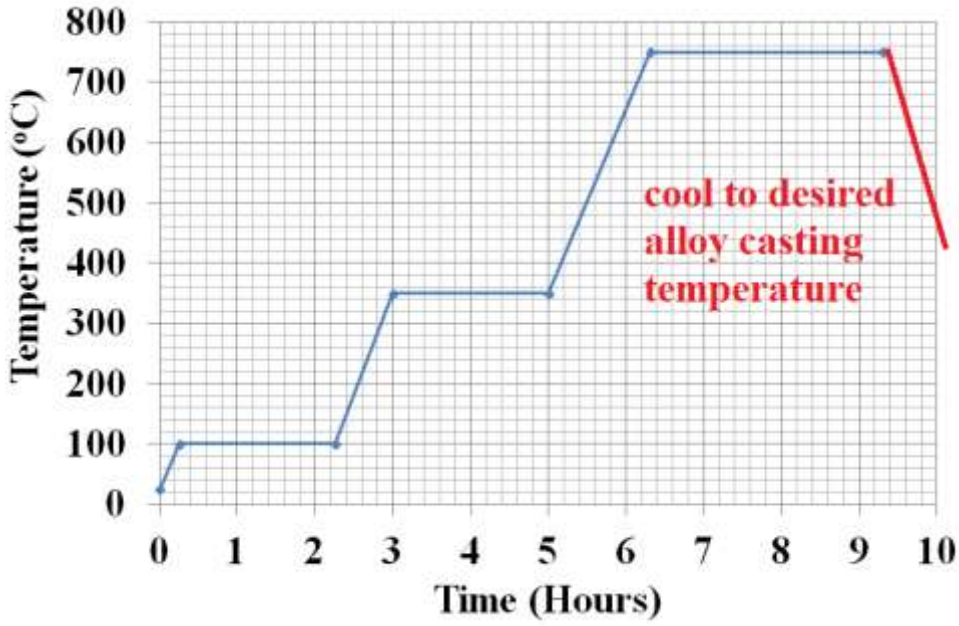
The following polymer burnout schedule needs to be followed to ensure complete polymer removal in the investment mold. **The user should pay attention to the relatively long hold at the two lower temperature stages (i.e. 100 and 350 degree C). Those two steps are mandatory to release the stress in the model to minimize/eliminate the chance of the resin model attacking the investment materials. Bypass those two low temperature steps could lead to very poor and porous surface!** Please allow the mold gradually cool to the desired alloy casting temperature before casting.

It should also be noted that the polymer burnout is very different from the conventional wax. In addition to melting at low temperatures as in the case of wax, the polymer can melt, evaporate, and burn at different temperature stages. Since burning is an important step for complete polymer removal, the user should use burnout ovens with a exhaust vent. Also, **sufficient air flow should be allowed in the oven/kiln, particularly underneath the flask. The user should raise the flask by 1-2" above the bottom of the kiln**. If the kiln/oven does not have an air inlet, the user could modify it by introducing air flow by drilling a small hole and attaching an external air pump. Alternatively, one could also keep the front door of the kiln/oven slightly open during the burnout process.



Please note that the above parameters are for 2" flask with relatively small wax trees. For users with larger flask and wax trees, the duration at each step should be proportionally increased.