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Ultracur3D® RG 3280

User Guideline

Introduction

The following user guideline is for professionals who use: Ultracur3D® RG 3280.
The safety data given in this publication is for information purposes only and does not constitute a legally binding Material Safety Data Sheet (MSDS). The relevant MSDS can be obtained upon request from your supplier or you may contact MAM directly at sales@forward-am.com.
For more information, please refer to the country specific MSDS for advice.

Are you looking for an updated User Guideline version? Check out the latest online version here.

Storage conditions and disposal considerations

Keep container tightly closed in a room temperature, well-ventilated place. Keep container dry. This material is more sensitive to storage temperature than most of our other materials. Try to keep the storage temperature always below 25°C. If material is not being used, fill it back through a filter in the corresponding material bottle. The filter prevents cured pieces or failed prints from going back into the bottle. Ultracur3D® RG 3280 must be disposed of in accordance with local regulations.
For more information, please refer to the country specific MSDS for advice.

Version 3.3

Intended use

Ultracur3D® RG 3280 is a technical material based on (meth-)acrylate resin for suggested LCD and DLP systems. Working wavelength: 365 nm, 385 nm or 405 nm. Below, you can find some suggested 3D printers and printing parameters. For more information contact MAM directly at sales@forward-am.com.

Examples of suitable 3D-Printers and settings

	Wavelength	Power	Curing time	Voxel depth
Creality Halot Sky CL 89	405 nm	2 mW / cm²	2.1 s	100 µm
MiiCraft Ultra 125	405 nm	2 mW / cm²	1.75 s	100 µm
MiiCraft Ultra 125 Y	385 nm	2 mW / cm²	2 s	100 µm
Nexa3D XiP	405 nm	3.5 mW / cm²	1.15 s	100 µm
Phrozen Sonic Mini 8k	405 nm	1 mW / cm²	2.1 s	50 µm
Stratasys Origin One	385 nm	5 mW / cm²	1.4 s	100 µm

If you cannot find your printer in the table or using the 3D Printing and Post Processing Settings Navigator you can use the values below as starting parameters. These are only approximations, different 3D printers may require different curing times and further optimization, but these values should be a good starting point.

The given values are all for printing at a layer thickness / voxel depth of 100 µm. If you need starting parameters for a different layer thickness, please contact us.

	405 nm Wavelength 3D Printer			
Power*	5 mW / cm²	4 mW / cm²	3 mW / cm²	2 mW / cm²
Suggested curing time	1 s	1.25 s	1.6 s	2.5 s

	385 nm Wavelength 3D Printer			
Power*	5 mW / cm²	4 mW / cm²	3 mW / cm²	2 mW / cm²
Suggested curing time	1.2 s	1.5 s	2 s	3 s

* Power measured directly on the glass

Printing process

The material should be processed at room temperature. It's highly recommended to shake the bottle well for about 1-2min before pouring into the vat. Please make sure to pour the resin slowly into the vat and wait a couple of minutes, until the bubbles are gone before starting the print job. Ultracur3D® RG 3280 should be well mixed before each print job, inhomogeneities or failed prints might occur when not mixed thoroughly. Shake the bottle for 1-2 minutes before refilling. Also make sure to filter resin inside the vat after a failed print job.

The 3D printer examples and settings stated above are only for general guidance. The fully optimized settings should always be determined by the users themselves, according to their specific needs. Please always refer to the user manual of the employed 3D printer for instructions on printer settings and handling.

Remove the parts carefully from the build platform with a suitable tool, for more information see the Instruction for Use of the used 3D-Printer. Always wear safety glasses since the ceramic parts can chip while trying to remove them from the platform. For easy removal, we recommend to remove parts shortly after the print is finished. Parts become more difficult to remove when they are left on the platform for a longer time.

When replacing/swapping the material, always clean the surfaces which come in contact with the resin, such as machine build platform, vat, glass, etc. If needed, dispose the used material and the cleaning products (solvents, paper towels etc.) adequately.

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Cleaning and post curing process

Ultracur3D® RG 3280 can be cleaned with 2-propanol or PLM-403-SUB. Please refer to either of the following cleaning procedures. We do not recommend using any common glycol-based cleaners like Ultracur3D® Cleaner, as this can lead to cracking in the final parts.

Option 1: Cleaning with 2-propanol and 2-propanol wipes (IPA)

- Step 1: Remove excess resin from the specimens using wipes/paper towel.
- Step 2: Rinse the parts with 2-propanol for a few seconds. Fine structures or holes may be better cleaned by using 2-propanol and a syringe or with a fine brush. Afterwards wipe again. Repeat the procedure until all the resin is removed.
- Step 3: Blow-dry the parts with compressed air/nitrogen, until the parts are clean.

Option 2: Cleaning with 2-propanol (IPA) and a washer with magnetic stirrer

- Step 1: Place the parts in a washer with magnetic stirrer with 2-propanol for 1-2 minutes. The recommended cleaning time depends on the exact washer type and printed geometry, but should be kept as short as possible in order to have the best final part performance.
- Step 2: Rinse the parts with 2-propanol for a few seconds. Fine structures or holes may be better cleaned by using 2-propanol and a syringe or by separate brushing.
- Step 3: Blow dry the parts with compressed air/nitrogen, until the parts are clean.

Option 3: Cleaning with PLM-403-SUB using an Ultrasonic bath OR washer with magnetic stirrer

- Step 1: Place the parts in a container filled with PLM-403-SUB and place this container in an Ultrasonic bath filled with water for 1-2 minutes. In the case of magnetic stirrer place the parts in the washer filled with PLM-403-SUB for 1-2 minutes. The recommended cleaning time depends on the exact washer type and printed geometry, but should be kept as short as possible in order to have the best final part performance.
- Step 2: Rinse the parts with PLM-403-SUB for a few seconds. Fine structures or holes may be better cleaned by using 2-propanol and a syringe or by separate brushing.
- Step 3: Blow dry the parts with compressed air/nitrogen, until the parts are clean.

Remark: whichever cleaning method is applied, the exposure to the cleaning solvent should be kept as short as possible, maximum 2-3 minutes in total or preferably even shorter. Longer cleaning may lead to cracking in the final parts and also to a decrease in mechanical performance.

For this resin, we recommend to just blow-dry the parts or leave them for a short time at room temperature to dry. We do not recommend drying at elevated temperatures as this can lead to lower tensile properties and lower temperature stability. Also, try to keep the time between printing, washing and UV post-curing short, as the material is quite sensitive in the green state.

Example of post curing procedures

Ultracur3D® RG 3280 parts require adequate post-curing to achieve the optimized final mechanical properties. After each post-curing cycle, the part needs to be flipped to achieve an even curing. Ultracur3D® RG 3280 can be post-cured using regular UV post-curing. Optionally, after UV post-curing, an additional thermal treatment can be done to improve the HDT and make the parts more white. Refer to the procedures below for optimal post-curing.

	UV lamp	Power in mW / cm²	Duration of post-curing	Notes
Dymax ECE 2000 flood	Hg Metal Halide Bulb (broad spectrum)	Ca. 140 mW / cm² at 405 nm	2 x 900 seconds	Shelf height K
OtoFlash G 171	Flash-bulbs (broad spectrum)	Ca. 3.5 mW / cm² at 405 nm	2 x 6000 flashes	With Nitrogen
Zortrax Curing Station	405 nm LED	Ca. 35 mW / cm² at 405 nm	2 x 31 minutes	

Example of additional thermal treatment after UV post curing (Optional!)

		Thermal Oven
Ramp up phase	2 hours	30 °C to 150 °C (ca. 86 °F to 302 °F)
Holding phase	3 hours	150 °C (ca. 302 °F)
Ramp down phase	2 hours	150 °C to 30 °C (ca. 302 °F to 86 °F)

These proceedings are only general guidelines. In the end, the user has to determine the optimum post-curing procedure based on their specific requirements and the equipment used.

Frequently asked questions and other tips and tricks

1. **Why do I see cracks appearing in my parts after UV post-curing, or after exposure to high temperatures?**

- This material is sensitive to the exposure time used during printing. In general, it is advised to slightly over-cure this material rather than under-cure to avoid the crack formation. If you have crack formation due to under-curing, this will often already be visible as microcracks in the green parts (under a microscope).
- In addition, this material is very sensitive to the specific washing and drying methods applied. Cracking can usually be avoided by keeping the cleaning time short (2-3 minutes max) and by using IPA rather than other resin cleaners. Using an Ultrasonic bath for cleaning can also cause cracks, unless PLM-403-SUB is being used as a cleaning solvent. Please refer to the washing instructions given above.

2. **Why do my parts have surface defects (e.g. small holes)?**

- Surface defects can usually be avoided by not using an ultrasonic bath, but rather wipes or a part washer. Please refer to the washing instructions given above.

3. **Why do my parts have lower mechanical properties than given in the TDS, or become more brittle after exposure to higher temperatures?**

- This material is very sensitive to the specific washing and drying methods applied. To get the best mechanical performance and temperature stability, do not use an ultrasonic bath and do not dry green parts at elevated temperatures. Please refer to the washing and drying instructions given above.
- In addition, when conducting tensile tests on this material, make sure you are using an extensometer and make sure the material is not slipping in the clamps. Both aspects can strongly affect the measured results for RG 3280.

4. **My parts are yellow, how can I make them more white?**

- Depending on the device used, parts will usually be a bit yellow or pink after post-curing. The best method to make parts more white, is to perform a thermal treatment like the one recommended above. Alternatively, washing longer or using an ultrasonic bath can also make parts whiter, but this is not necessarily recommended, see the previous questions.

5. Why are my parts difficult to remove from the platform?

- To make it easier to remove parts from the platform, we recommend adjusting the base curing time where possible, and to not leave the parts on the platform too long after the print has finished. Leaving the parts for a longer time on the platform will result in increasing difficulty to remove them from the platform.
- The material will be very brittle in its green state and will easily break. Be extra careful when removing the parts. A good method is to use a sharp chisel and a rubber hammer and carefully apply a small force from all the directions of the part.

6. The resin seems to be curing spontaneously in the printer vat. What is happening?

- This resin is more sensitive to daylight / office light than most of our other products. Make sure to keep exposure to ambient light as limited as possible, or use yellow light / light filters. We recommend using filters that block all wavelengths below 520nm, as for example commercialized by Lithoprotect.

7. Why do I see small flakes being formed on part surfaces or in the printer vat?

- This is due to the high reactivity of the resin. Try to print at a lower power, or reduce the amount of parts per build. What can also help is to keep the resin a bit colder, e.g. by keeping it in the fridge before printing, or by giving it enough time to cool down during / after printing.

8. Why does the vat film/membrane become foggy after a few print jobs?

- This is due to the abrasive nature of the ceramic particles. However, in our experience, this abrasion effect is limited and also does not show in every printer, and the vat film is mostly still perfectly usable despite the foggy appearance.

9. Why does the base of my part have black or grey spots?

- This happens when using an aluminum platform. Usually, the effect is limited and does not cause any other issues with the resin or part performance. To overcome the issue, thoroughly clean the platform after each use (repeat cleaning until the paper towels do not become black anymore), or replace the aluminum platform with an anodized aluminum or with steel.

10. How can I clean material leftovers from the vat, platform and tools used?

- Cleaning of tools can be quite challenging with this material. Some techniques that can help:
- First try to clean the tool with IPA/Acetone, then dry it with air & wipes. Once it is completely dry, use a dry tissue to brush any leftovers off gently. Then repeat the process until it's clean.
- Reduce the amount of leftover resin as much as possible before cleaning with IPA. This can be done by fixing components under an angle to let resin flow off by itself, or by using tissues to clean most of the resin, before using IPA.
- Avoid contamination e.g. by not touching tools with dirty gloves or by wrapping tools with paper towels before using them

11. How often do I have to mix this resin to keep the ceramic particles well-dispersed?

- The resin has been specifically designed to have a very stable dispersion of the particles. In our experience, the resin can last several days without showing any visible settling. However, for the best results, we would still recommend to briefly mix/stir the resin in the vat once a day, or before any longer print job.
- Also mix/stir the resin before emptying the vat e.g. in another bottle. Otherwise a residue of sedimented ceramic particles may be left on the bottom of the vat.

12. Can I Post-Treat my parts using a Sandblasting machine?

- Glass Beads can be used for additional post-treatment. This will give a very smooth surface finish, but some details may be lost. In our experience, mechanical performance is not affected by sandblasting.

13. Why do my printed parts have surface defects after printing (e.g. small holes)?

- Make sure all bubbles are gone before starting a print job.
- Check your material vat/ foil if there are any defects.
- Depending on the machine and geometry reduce the printing speed and increasing the lift distance will give the material a chance to flow properly.

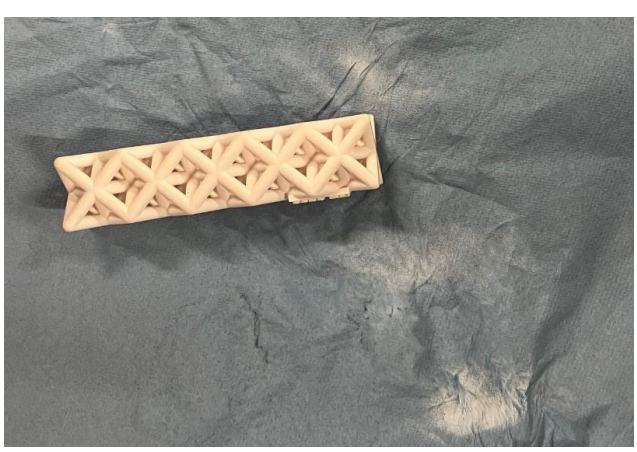
14. My parts warp, what should I do?

- Depending on your post curing unit Ultracur3D® RG 3280 can get quite warm while post curing. In case of warping, it's recommended to post cure slowly with more pauses between the intervals.
- Adjust the support structures, machining is quite easy for Ultracur3D® RG 3280, if flat surface is required, increase Z height by 1-2 mm and then just mill it. See also our Machining and Processing Guide.
- Some adjustments of the design of the part could also help with warping.

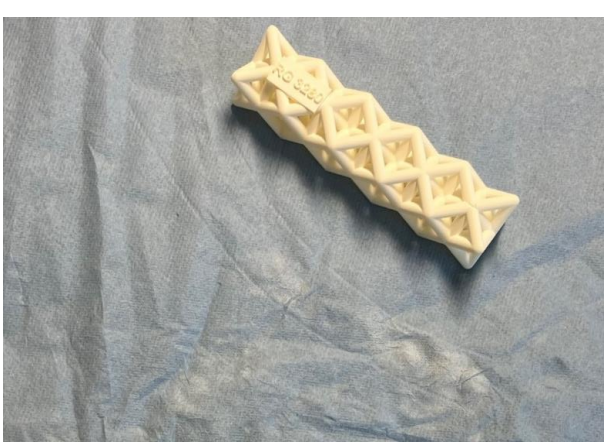
15. My part shows chalkiness (fine powder coming off the part), how can I reduce this?

- The chalkiness of the parts will depend on the exact process used. There are several ways to reduce the chalkiness:
    - use PML-403-SUB as cleaning solvent, (with Ultrasonic or washer with magnetic stirrer),
    - use an additional thermal treatment after UV post cure (as described above),
    - add an extra washing step after post curing (we have good results simply using distilled water + ultrasonic for about 2 mins)
    - or other postprocessing methods like sandblasting can help.

Chalkiness after post-curing



Chalkiness after thermal-treatment



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