Ultracur3D® RG3280 by Forward AM

Material Processing Guide

ORIGIN

This guide provides information for processing Ultracur3D® RG3280 by Forward AM.

Profile

In GrabCAD Print™, select the *Rigid* or *Rigid - Conservative* default support profile.
The conservative support profiles create more contact points between the model and the support structure, thereby increasing print success rates.

Clean

Cleaning Steps*	Duration
1st bath of **IPA** (agitated—avoid ultrasonic) (Rinse off excess resin from the surface with IPA.)	1 minute
Dry parts with compressed air or nitrogen.	10–60 seconds
Manually wash parts with IPA and a cleanroom wipe. (For fine features, spray with IPA.)	1 minute
Dry parts with compressed air or nitrogen.	10–60 seconds

* If a part is not fully clean (still appears wet after compressed air or nitrogen treatment with no evaporation), repeat manual washing step, followed by compressed air or nitrogen drying.

Wait

- Limit solvent exposure to ≤2 minutes to avoid cracking and reduced performance. For this resin, dry parts with compressed air or briefly at room temperature.
- Minimize delay between washing and UV post-curing, as green parts are sensitive.

UV Curing

Use the UV curing system for your printer.

Origin Cure™/CureLite™
(Origin Two/Origin One+)
- Place parts.
- Select the material program.
- Tap **Start**.

Dymax ECE5000
(Origin One)
- Place parts.
- 2—5 minutes per side
- Shelf: I

Thermal Curing

Phase	Duration	Temperature
Ramp up	125 minutes	25°C to 150°C (1°C/min)
Hold	3 hours	150°C
Ramp down	125 minutes	150°C to 25°C (1°C/min)

Recommended: Create a thermal curing program for this step.

Material Overview

Ultracur3D® RG3280 by Forward AM is a highly loaded, ceramic-filled material with extremely high stiffness around 10 GPa and a heat deflection temperature above 280°C. The white, ceramic-like colored resin is very easy to handle and print, especially considering the high particle loading. This is possible by keeping the viscosity low and limiting the settling of particles. With its high stiffness and temperature resistance, the material is ideal for tooling, molding, and wind tunnel testing applications.

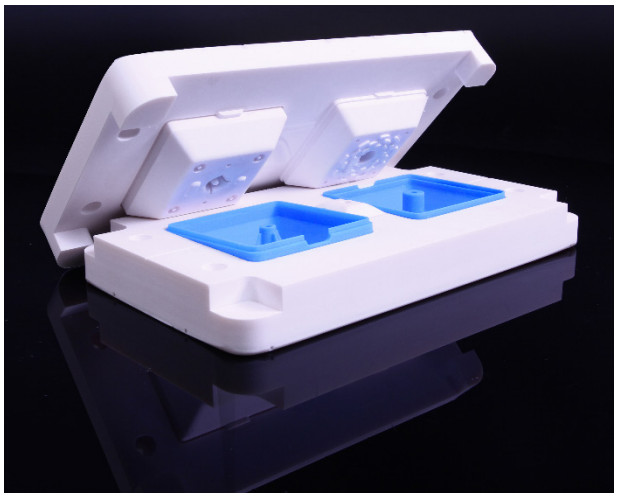
- For details regarding material types, model selection for additive production, and optimizing accuracy and throughput on Origin printers, refer to the P3 Origin Operations and Applications Guide.
- To learn more about the accessories related to the P3 Origin printers, refer to P3 Origin Accessories Product Essentials.

> Ultracur3D RG3280 is a Validated material in GrabCAD Print™ that passed basic reliability testing.

Table 1: Material features

Feature	Value
Color	White Ivory
Maximum unsupported overhang length	1.5 mm
Maximum span length	5 mm
Minimum unsupported overhang angle	15°
Minimum vertical wire diameter	
1 mm height	0.5 mm
3 mm height	0.5 mm
5 mm height	0.5 mm
Minimum unsupported wall thickness	
5 mm height	0.25 mm
10 mm height	0.25 mm
Minimum hole diameter in Z	0.5 mm
Minimum hole diameter in XY	0.5 mm

Figure 1: Example RG3280 model



Material Processing Guidelines

Pre-Print Handling

- Ultracur3D RG3280 is formulated to print optimally on Origin® industrial P3 DLP printers.
  - Refer to the Safety Data Sheets and carefully read the relevant sheet with instructions and other details about health and safety.
  - For more in-depth processing information, refer to the Forward AM User Guidelines available on the Forward AM website. The site also provides additional data about the material.
- Minimize light exposure—RG3280 resin is highly reactive. Limit exposure of the resin tray and pre-cleaned parts to light, whenever possible.
- Use safelight conditions—A safelight equipped with yellow lights is recommended for optimal handling.
- Follow post-processing protocols—RG3280 is particularly sensitive to post-print operations. Strictly follow proper cleaning, drying, and post-curing procedures.
- To minimize surface roughness:
  - Print in a conservative default material profile.
  - For roughness due to unvented volumes, adjust the model's orientation or incorporate drainage channels and vent holes in the design to allow trapped resin to flow out effectively.
- You can further enhance the build platform adhesion. We recommend using an initial raft or brim, and attaching the required part to this layer.
- Ensure a fully flat surface—especially at the parting line and on the back of molds—to prevent stress fractures when clamping. If a flat surface is not feasible, optimize printing strategy (adjust parameters and/or orientation).
- Mix Ultracur3D RG3280 thoroughly before each print job to ensure consistent print quality and improve print success.

Print Setup

- Due to the ceramic fill, do the following before printing:
  1. Shake the resin bottle for 30 seconds or use a roller machine, before pouring it into the resin tray.
  2. Stir the resin in the resin tray with a suitable mixing tool (for example, silicone spatula) until the mixture is fully homogenized.
- Printing flat, large surfaces greater than 100x100x50 mm^3, requires a raft or brim to avoid warpage or detachment from the build platform.
- Validated settings work well for most geometries.
- The tray sheet of the resin tray degrades quickly. To prevent leaks onto the midplate glass:
  - Ensure the resin tray is properly installed.
  - Inspect it for wear and tear before each print.
  - Replace the tray sheet weekly.
  - Avoid sharp-edged corners in your model design.
- After a failed print, perform a **Full Area Projection** peeling process to ensure no polymerized residue remains.

- Build platform adhesion issues might occur due to the material's sensitivity to unvented volumes. This can cause the print to separate from the build platform. To mitigate this, use a raft or brim, or begin the print on a support structure. These approaches help vent enclosed holes, improve adhesion, and reduce the risk of separation.
- Minimize the time between printing, cleaning, part removal, and post-curing.
- Pour resin slowly into the resin tray and allow a few minutes for bubbles to dissipate before starting the print job.
- Print temperature: RT
- Irradiance: 5 mW/cm^2

Part Removal

- Clean the work area and tools without delay to prevent resin solidification.
- Place the build platform with the printed parts on a non-reactive portable surface and use a no-drip jig to avoid dripping resin when performing the transfer from the printer onto the non-reactive portable surface.
- Remove parts shortly after printing. Delayed removal can make detachment more difficult and increase the risk of damage.
- Remove all parts from the build platform according to the following guidelines. For more details, refer to the relevant User Guide.
  - Use a metal Origin scraper tool (ORIG-00305) or a putty knife, which is helpful for detaching parts and supports from the build platform.
  - For parts with large cross-sections, apply careful, controlled pressure to detach them from the build platform.
  - Always push the scraper away from your body, maintain proper blade direction, and keep hands clear of cutting edges.
  - Be patient and remove material gradually rather than all at once.
  - Do not pry with a blade.
  - Avoid using the corners of the scraper as this might damage both the part and the build platform coating.

Cleaning

- Due to RG3280 resin's high reactivity, begin cleaning immediately after part removal.
- The overall cleaning procedure consists of a 4-step process, involving one solvent bath in a swirl-based agitation bath and manually washing the parts. Dry with compressed air or nitrogen after the bath and the manual washing step.
- Inspect the part after the manual washing step. If it still appears wet or shows no signs of evaporation, repeat the manual washing followed by drying with compressed air or nitrogen until the part is visibly clean and free of resin (see the Cleaning table on page 1).
- Always aim to minimize the part’s exposure to solvent during cleaning. All materials will absorb solvent in their green state to some degree. Minimizing time in solvent will reduce the impact on mechanical properties.
- Wash parts in a solvent bath of “used” IPA followed by manually washing. If the IPA is visibly cloudy, replace it with clean IPA.

- Keep dedicated solvent containers for each material. Containers should close with an air-tight seal to prevent IPA evaporation.
- If needed, repeat the cleaning cycle to ensure all resin is removed. Spot cleaning with a clean room wipe wetted with IPA may help in hard-to-reach areas.
- After the bath, use compressed air or nitrogen to dry parts, being especially gentle around delicate features. Always spray machinery or other parts away from the body.
- Negative features, interior corners, and blind holes may be difficult to clean. A cotton swab soaked in IPA can be helpful.
- Minimize cleaning time. Prolonged exposure might cause cracks in printed parts and reduce their mechanical performance.
- Clean all surfaces that come into contact with resin (for example, build platform, resin tray, and midplate glass) when replacing or swapping materials.
- Use IPA for cleaning. Limit solvent exposure to ≤2 minutes to minimize absorption and preserve mechanical properties.
- After cleaning, use compressed air or nitrogen to dry the parts, or allow them to dry briefly at room temperature. Avoid elevated drying temperatures.

Post-Curing

- This material requires a two-step post-curing process to ensure the best possible mechanical and thermal properties. This process is divided into UV curing and thermal curing steps:
  1. UV Curing
  2. Thermal Curing
- In some cases, leaving the support structures intact throughout the entire post-processing procedure, can prevent deformation.

UV Post-Curing

- Stratasys recommends Dymax ECE5000, Origin Cure, Origin CureLite, or an equivalent curing solution provided by Stratasys (see the UV Curing table on page 1).
- Flattening with Weight—If the model has a flat geometry, place a glass substrate on top with a weighted object to minimize warpage.
- Use the curing system for your printer:
  - **Dymax ECE5000** (Origin)—Expose the part in the Dymax ECE5000 for the specified time per side. Thin-walled parts may warp during the post cure process. To avoid this, post cure for shorter intervals, flipping part between exposures. Begin with a 10-second exposure per side to build initial strength before longer intervals.
  - **Origin Cure** and **Origin CureLite** (Origin One+/Origin Two)—Use the relevant curing program.
- From the unit menu, select the correct program according to the material used for printing.
- Place parts on the glass plate and follow these guidelines (For more information, refer to P3 Origin Operations and Applications Guide):
  - Ensure all parts are within the effective curing area.
  - Orient parts properly to avoid deformation and minimize overhanging parts.
  - Spread out the parts uniformly and leave sufficient gaps between parts so they don't touch each other.

- Place large parts close to the center of the glass plate to minimize shadows on the smaller parts.
- Tap **Start** and wait for the countdown to finish.

Thermal Post-Curing

- Optimizing Oven Setting—Ensure uniform heat distribution within the curing chamber and use a calibrated temperature profile to reduce thermal stress on the printed parts.
- Using Controlled Cooling—Gradually cool the parts after post curing instead of exposing them to sudden temperature changes, which can contribute to deformation or thermal shock.
- Place the parts in an oven (for example, Memmert UF75plus) with the following heating profile:
  - Ramp up 1˚C/min to 150˚C.
  - Hold (Isothermal) for 180 minutes at 150˚C.
  - Ramp down 1˚C/min to RT.
- To improve heat deflection temperature (HDT) and enhance whiteness, an additional thermal treatment may be performed after UV post-curing. This step is especially beneficial for applications requiring higher thermal stability or a brighter appearance.

Post-Processing

- When mechanically reworking molds, consider the material's brittleness by setting the following:
  - Use a very low material removal rate (about 0.1 mm).
  - Moderate to slow travel speeds for milling and grinding.
- Machining Guidelines
  - **Drilling**—Use low pressure to minimize chipping. Drill holes incrementally. For holes larger than 5 mm, print them undersized and redrill to final dimensions.
  - **Milling**—Begin with slow settings and gradually increase speed until optimal results are achieved. Use freshly sharpened tools for best performance. Up-cut milling generally yields better outcomes.
  - **Tapping**—Apply cutting oil to significantly improve results. Manual tapping is effective up to M5 diameter; larger diameters may chip. Ideally, threads should be printed directly and only recut if necessary.
  - **Sanding**—Sanding quickly smooths out minor surface irregularities. Any grit of regular sandpaper can be used. Apply consistent pressure to achieve a uniform finish.
  - **Tumbling**—Parts can be smoothed using a polishing machine or tumbler. For example, tumbling for 90 minutes at 290 RPM with PM10 grinding chips can produce slightly rounded edges and a smooth, homogeneous surface.

Post-Printing Maintenance

- Proper maintenance and post-failure cleanup significantly improve print consistency and reduce the risk of recurring defects.
- After a print failure, in the printer perform **Full Area Projection** to remove any remaining support structures or leftover material. You can use a peeler to remove any film.
- Follow these precautions to maintain print quality and prevent further failures:

- **Replace the Tray Sheet**—If residues persist or the tray sheet is worn out, consider replacing it to ensure optimal printing conditions.
- **Filter the Resin**—Use a 190-micron paper filter to drain and remove any cured particle contamination from the resin tray, preventing defects in subsequent prints.
- **Clean the Build Platform and Resin Tray**—Thoroughly wipe down the build platform and resin tray to eliminate any residual cured material that could interfere with adhesion or cause inconsistencies.
- **Check for Optical Clarity**—Ensure the light source and optical path are free of dust or residue that could affect cure uniformity. Pay special attention to the midplate glass and to the tray sheet located at the bottom of the resin tray, as contamination in these areas directly impacts light transmission to the resin.
- **Verify Printer Calibration**—If failures persist, check that the projector irradiance and printer settings such as exposure time, intensity, and layer adhesion are within specification to rule out process-related issues.

Troubleshooting

- **Print Failure**—
  - Check for leaks from the tray sheet to the midplate glass, which is located underneath the resin tray.
  - Filter the resin inside the resin tray to remove any solid residues.
  - Use the **Full Area Projection** feature on the printer to help identify and remove any remaining support structures or leftover material. If a thin film remains on the tray, carefully remove it using a peeler tool to avoid damaging the tray surface.
- **Fitting Issues**—Adjust edge compensation, if needed. Optimize model scaling.
- **Curling and Detachments**—Add extra Z base. Print on the support. Use a raft or brim.
- **Tray Sheet Leakage**—Replace Teflon once a week.
  - Check the Teflon after a failed print.
  - Avoid sharp-edged corners in the model.
  - Consider printing sharp-edged models with conservative support profile to reduce puncturing the tray sheet.
- **Surface Defects**—For surface defects such as small holes on parts, avoid using an ultrasonic bath. Use wipes or a part washer for cleaning.
- Cracks **Appear**—If cracks appear on parts after UV post-curing or exposure to high temperatures:
  - Slightly over-cure the material, rather than under-cure to prevent crack formation.
  - Keep cleaning time short.
  - Avoid using an ultrasonic bath for cleaning.
  - Do not dry green parts at elevated temperatures.
  - Keep the time between printing, washing, and UV post-curing short as the material is sensitive in its green state.
- **Verify Printer Calibration**—Check projector irradiance and printer settings (exposure time, intensity, layer adhesion). Recalibrate if failures persist.

For more information about Stratasys systems, materials, and applications, visit www.stratasys.com.