



Customer Information Bulletin

CIB

CIB #: 0110/B
Date: 20 July 2010
Status: Non-confidential

Subject: Tips & Information for part building with Accura[®] CeraMAX[™] Composite material

1. **Software version:** Some software enhancements have been made that facilitate the use of this material. Please make sure that the most current software version is loaded.
2. **Specific values:** The values for Dp and Ec are shown below. In addition, different machine specific shrink/scale factors and linewidth compensation values must be used. The baseline or starting values to be used with Accura CeraMAX material are shown below.

	iPro [™] 9000 System	SLA [®] 5000/7000	Viper [™] SLA System
Dp (mils)	5.7	5.7	5.7
Ec (mJ/cm ²)	7.2	7.2	7.2
Baseline Scale Factors (x, y, z)	1.002, 1.002, 1.000	1.002, 1.002, 1.000	1.0015, 1.0010, 1.0000
Baseline Linewidth Compensation Value	0.075 mm (0.003")	0.150 mm (0.006")	0.150 mm (0.006")

3. **Supports preparation:** Careful preparation is critical for success with Accura CeraMAX material. Supports that are too close together may limit the flow of resin, and result in mounding on the tops of supports. Mounding that occurs during support building, prior to sweeping, can become cured and thus result in a blade collision. To minimize this mounding, the following steps should be taken:
 - a. **Delete excess supports:** Excess supports should be deleted during part preparation so that there is sufficient spacing between support vectors. Because the resin has higher viscosity than many other materials, this space is required to allow the resin to flow. If the space is not sufficient, the resin will not form a flat surface during the z-wait interval. This issue only occurs when lots of supports are generated in a small area. Care should be taken to delete supports that are not required.
 - b. **Mechanical properties of supports:** Accura CeraMAX supports have been described as "hard and crisp." The default support parameters have been optimized for successful part building. Support parameter modifications may cause build crashes. Proceed with caution when making any support parameter changes.



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4. **Loading resin:** When loading resin, before lifting up the vat, make sure that the resin surface is free of all bubbles. It is especially important that the area which will be enclosed by the baffle of the diode leveling assembly is free of any bubbles. If there are bubbles inside this baffle, the leveling system cannot operate properly.
5. **Build start position:** Setting the build start position is important. At the beginning of the build, the top surface of the platform must be very close to the resin surface. The resin should fill the holes on the platform, but not cover the top surface of it. This is to allow for proper adhesion of the cured support to the platform, but to eliminate supports getting cured deep within the platform holes, which can prevent the free flow of material.
6. **Surface bubbles at build start:** Any bubbles present on the resin surface should be removed before starting the build. Bubbles can be removed either by blotting the resin surface with a paper towel, or by using a hairdryer or low-pressure compressed air.
7. **Refill material:** Upon opening new containers of Accura CeraMAX material, stir the contents for about 30 minutes with a mechanical stirrer (such as is used for mixing paint). In addition, prior to adding resin to the SLA system, stir the resin again for about 30 minutes with the same stirrer.
8. **Hatch overcure values:** Hatch overcure has been optimized for both accuracy and mechanical properties. It is highly recommended that the hatch overcure values not be reduced from default. However, hatch overcure may be decreased to 0.002 inch, to increase build speed. Note that this increased throughput comes at the cost of accuracy and mechanical properties of both green and post cured parts.
9. **Cleaning and finishing parts:** When cleaning Accura CERAMAX parts, a white residue may remain. This residue can be easily removed by scrubbing the parts with a soft bristle brush, prior to UV postcure. If bead blasting will be used for finishing, it is recommended that parts be beadblasted prior to UV postcure. Parts treated in this way will have a nice white satin appearance. The recommended cleaning procedure is as follows:
 - a. Clean the parts on the platform in the TPM dip tank for 25-30 minutes (same as other 3D Systems resins).
 - b. Brush the parts with a soft bristle brush quite vigorously, being careful not to apply so much force that the parts are damaged.
 - c. Rinse the part with water.
 - d. Use compressed air to dry the part and inspect for excess uncured material remaining on the surface of the part.
 - e. Repeat steps b through d as many times as necessary until the majority of the material has been removed from the part. In most cases this will take about 3 cycles.



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10. **Resin Stabilization:** Like the other resin types, Accura CeraMAX needs to be stabilized. Please follow 3D Systems Resin Stabilization guidelines to maintain the best performance and prolong resin life.
11. **Vat maintenance:** Accura CeraMAX is a composite material. While the formulation has been engineered to minimize settling, it is still recommend that the material be mixed regularly.
 - a. **Between each build, use the platform** to stir the resin for a minimum of one hour, using the full available z-stroke for your system. General stirring instructions are shown below. Please note that each system's stirring method varies slightly depending on software type and version, so only general instructions are provided:
 - Position platform 0.200" below the current resin surface (no need to level the resin)
 - Set stirring velocity, normally 1 to 2 inches per second
 - Set the stirring stroke (negative z distance from stirring start position) to cover the full z-stroke for your vat/RDM depth
 - Set stirring time
 - Start stirring
 - b. **Once a week, stir using a squirrel-cage** (or similar) device attached to a drill motor. You'll need to remove the platform before stirring, in order to access all the areas of the vat/RDM. On large-frame systems, make sure to place the squirrel-cage in each corner of the vat/RDM, and in the center, to properly stir the entire area. You should stir for a minimum of 1 hour total time.
 - c. **If a large-frame vat has been stored and idle** for more than 2 weeks, more significant stirring will be required. Please follow the procedure below. If possible, a high-shear mixer is recommended. If only a squirrel-cage is available, longer stirring will be required.
 1. Raise the platform and elevator arms out of the resin and remove the platform.
 2. Wipe the elevator arms dry, to prevent resin drips on the floor after vat/RDM removal.
 3. Remove the vat/RDM from the SLA system.
 4. Use a stiff scraper with a long handle to scrape the bottom of the vat/RDM completely, in order to loosen any material that has settled to the bottom.
 5. Leave all the material that was scraped from the bottom in the vat/RDM, so that it can be blended back into the resin.
 6. Obtain a mixer with 2 ten inch blades, and a variable speed ½ to ¾ HP motor.
 7. Lower mixer into vat/RDM to about 1 inch above the bottom.
 8. Center the mixer in the vat/RDM.
 9. Turn mixer on at a low speed and slowly increase the speed until the resin nears the point of splash out, and then lower the speed slightly.



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10. After about 45 minutes, move to mixer close to one end of the vat/RDM, and continue mixing there for about 45 minutes.
 11. Move the mixer to the other end of the vat/RDM and mix there for 45 minutes.
 12. Remove the mixer from the vat/RDM.
 13. Place the vat/RDM back in the SLA system, and reinstall the build platform.
 14. Stir resin in the vat/RDM using the stir function in the 3D Print or Buildstation software until bubbles are all gone from the resin surface (this may take an hour or two).
 15. Ready to build again.
12. **Thermal Post curing:** Parts built in CeraMAX material may be thermally post cured to achieve enhanced thermal resistance. This is particularly beneficial for higher temperature applications. In order to thermally post cure a CeraMAX material part, the part should be treated as follows:
- a. Clean and UV post cure as normal.
 - b. Place the part in a programmable thermal oven.
 - c. Slowly raise the oven temperature to 120° C (252° F) over a period of approximately 2 hours.
 - d. Hold the temperature for at least 2 hours, depending on the thickness of the part. Thin parts, those around 3mm (~0.125"), require only 2 hours at elevated temperature. Thicker parts will require more. Your goal is to have the entire part mass reach equilibrium.
 - e. Shut off the oven, and slowly return the temperature to room temperature, over approximately 4-8 hours. It is important not to cool parts rapidly as thermal shocking may occur and result in cracks in the part.



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