



Designing in KeyShot for PolyJet 3D Printing

Overview

With a seamless digital workflow from KeyShot® and GrabCAD Print™, designers of 3D models can design faster, communicate better, achieve design intent, accelerate delivery time and reduce costs.

Early in the design process, start preparing and testing their Color Material Finish (CMF) model with all the required information, including shape, color, transparency, materials, textures and much more. Once the CMF model is ready, the file is exported to a 3MF file format and printed using GrabCAD Print on PolyJet™ 3D printers.

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This simplified workflow ensures efficiency, accuracy and quality for every PolyJet printed model.

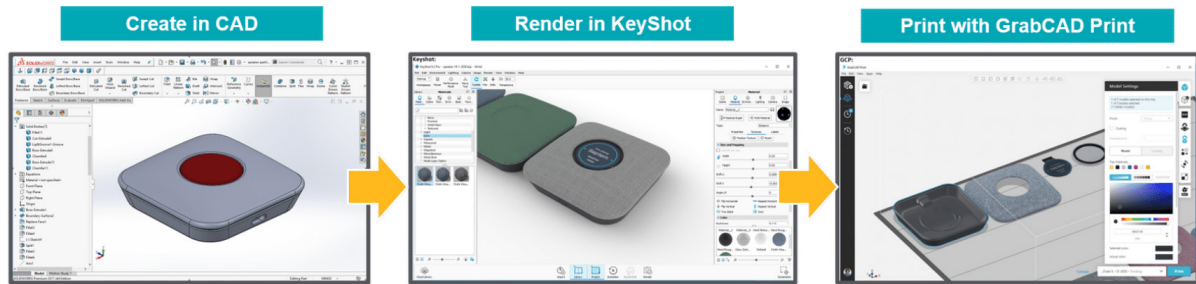


Figure 1: A simplified workflow

This document describes how to design in KeyShot for optimum results when printing with GrabCAD Print on PolyJet 3D printers.

- A. Supported Materials and Material Settings
- B. Units, Dimensions and DPI
- C. Surface Resolution (Tessellation)
- D. Color
- E. Transparency
- F. Label Projection
- G. Label and Texture Resolution
- H. Bump and Displacement
- I. Additional Resources

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Recommendations and Tips

A. Supported Materials and Material Settings

Many of the materials available in KeyShot can be 3D printed with high fidelity. However, some materials are not supported. For optimum results, refer to the table below.

Prefer	Avoid
<ul style="list-style-type: none">• Paint• Plastics• Textures - procedural and mapped• Metal color• Most transparencies• Labels• Gradients• Displacement• Bump• Wood, stone, fabric	<ul style="list-style-type: none">• Fuzz• Sub-surface• Reflective• Light• Real metal• Soft• X-Ray• Cutaway• Other render-only appearances

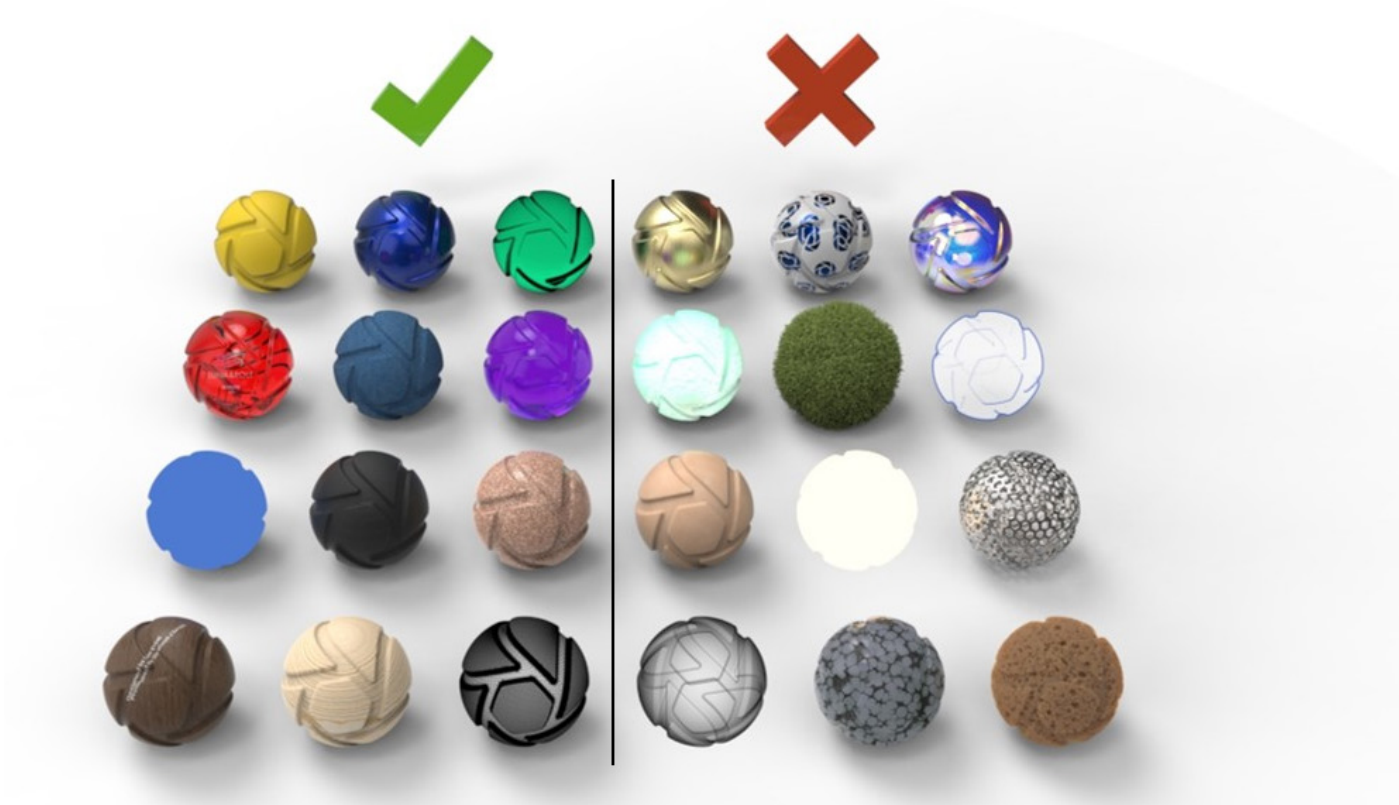


Figure 2: Settings that export as expected (left); Settings that do not export as expected (right)

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B. Units, Dimensions and DPI

When imported into KeyShot, some file types do not contain units. If the units are not defined, this may adversely affect model size and export time.

- Always make sure that the units are set correctly, when:
 - Exporting from the modeling software
 - Importing into KeyShot
 - Exporting from KeyShot

If the units need to be modified, do this in the CAD program. Then, export and import into KeyShot.

- When exporting to 3MF:
 - Use a DPI that is between 400 to 600.

As a rule, part resolution should be higher than the printer resolution. Currently, the default resolution in KeyShot is 400 DPI. KeyShot applies DPI only to textures, labels and colors. If you do not have textures, labels, or colors, KeyShot ignores the DPI. Under 300 DPI the model appearance will be poor.

- The *Number of samples* should remain 16.
- Select the *Prefer Textures* option.

If *Geometry Nodes* is selected, the displacement is exported as tessellated polygons, which increases the export duration and results in a larger file size.

- Clear the *Use Calculated Depth* check box.

If this option is selected, it applies the color to transparent parts according to the thickness of each polygon. It simulates transparency thickness when the core is clear. Clearing this check box results in a faster file export.

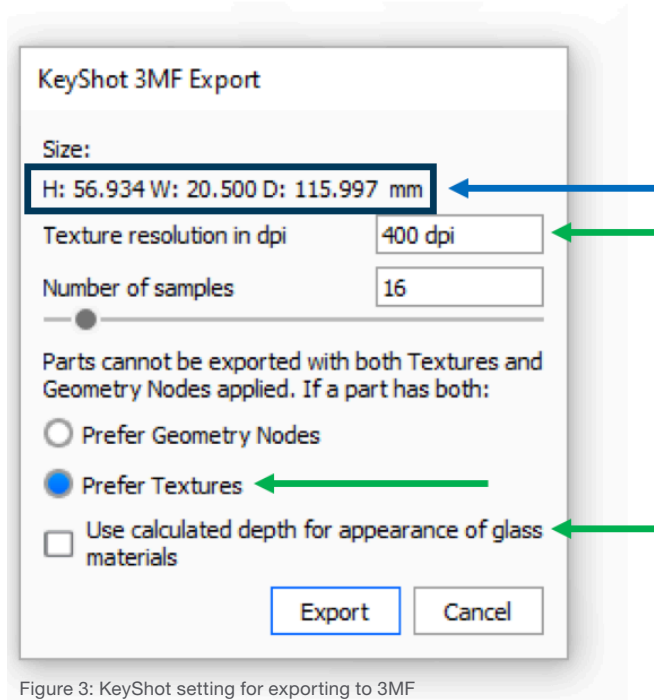


Figure 3: KeyShot setting for exporting to 3MF

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C. Surface Resolution (Tessellation)

The quality of the printed part is defined by the density of the triangle mesh. The more complex the surface, the more triangles are produced. If there are not enough triangles to define its complexity, the result is a faceted printed model. If the facets are visible on the screen, they will also appear in the printed model.

- Smoothing shaders applied in KeyShot do not tessellate or add triangles to the model. Make sure that the model resolution is suitable for 3D printing.
- Load the model into GrabCAD Print and examine the model without the smoothing to verify that its surface is smooth.

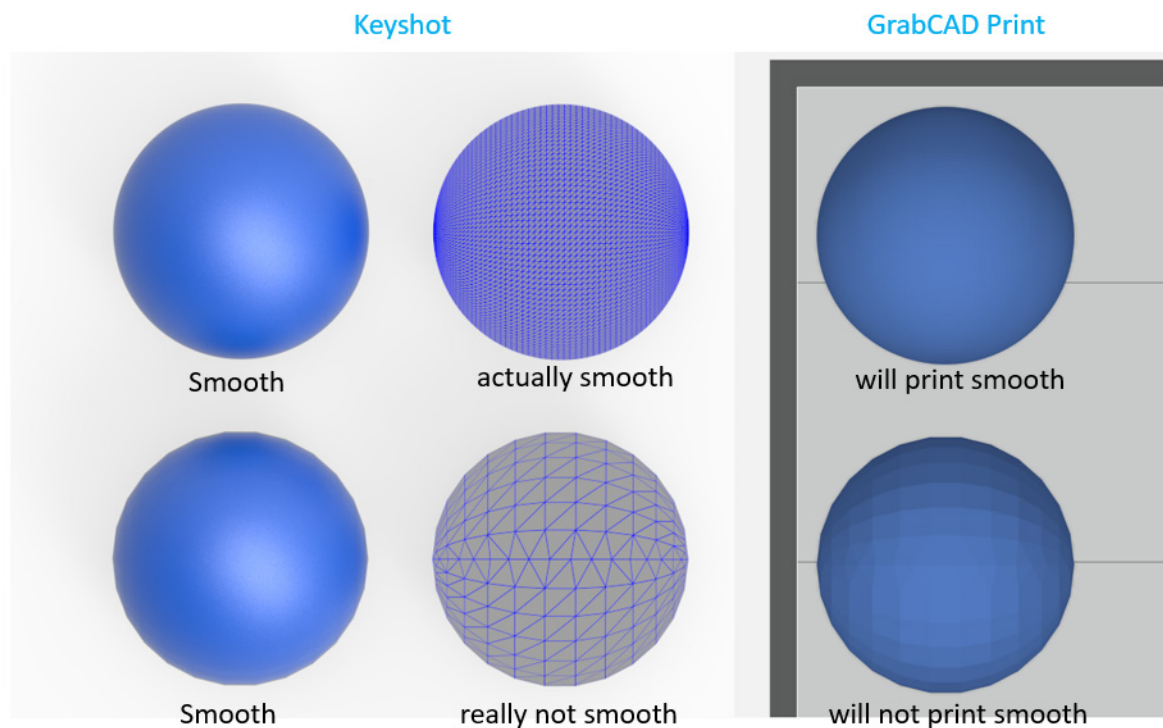


Figure 4: Model with and without smoothing shaders (left); Verifying smoothness in GrabCAD Print (right)

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D. Color

Adjacent shells that are thinner than 2 mm and have different colors may result in inaccurate and dull colors on the printed model.

- The model's inner shell is automatically printed in white when the shell thickness is at least 2 mm. This white inner shell ensures vibrant and accurate color on the printed models. If the inner shell thickness is less than 2 mm, there is no room for the white inner shell, and the colors are less accurate and less vibrant.
- When adjacent shells have different colors and their thickness is less than 2 mm, combine the shells before importing them into KeyShot, then paint the faces of the surface (color per shell).

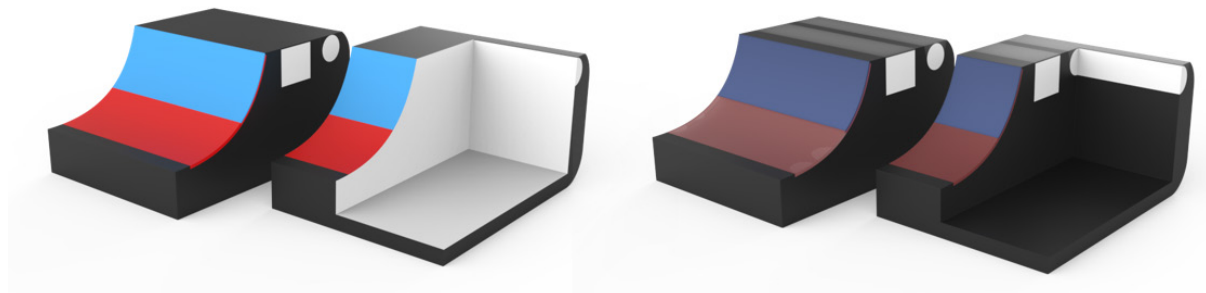


Figure 5: Combined shells with color per surface (left); Separate shells, less than 1 mm thick (right)

E. Transparency

Some of the transparency types in KeyShot may cause unpredictable and inconsistent results in the 3D printed model. Follow these guidelines for best transparency results:

- To print *fully* transparent models:
 1. In KeyShot, assign one of these material types:
 - Glass
 - Glass (solid)
 - Gem
 - Liquid
 - Dielectric
 2. Set the color to white (#FFFFFF).

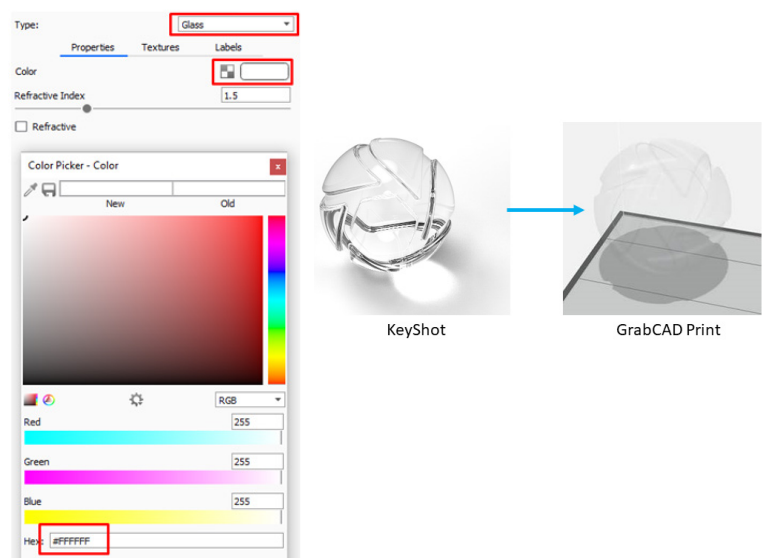


Figure 6: KeyShot settings and appearance in GrabCAD Print (sample)

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- You can also use the following *Plastic* types; however, the model might not be fully transparent.
 - Plastic (Cloudy)
 - Plastic (Transparent)—use the Specular *transmission* field to set the color. All other color-related fields are not supported in GrabCAD Print and do not appear in the printed model.
- Avoid using these material types, as they are not supported by GrabCAD Print, and may result in unexpected results:
 - Translucent Medium
 - Scattering Medium
 - Plastic (Transparent)—Diffuse / Specular / Transmission setting
- To ensure that models have a realistic solid plastic / glass appearance—the thicker the part, the darker and more saturated the colors—in GrabCAD Print, select the *Same material* check box. This applies the same color and transparency used for coating to the core.

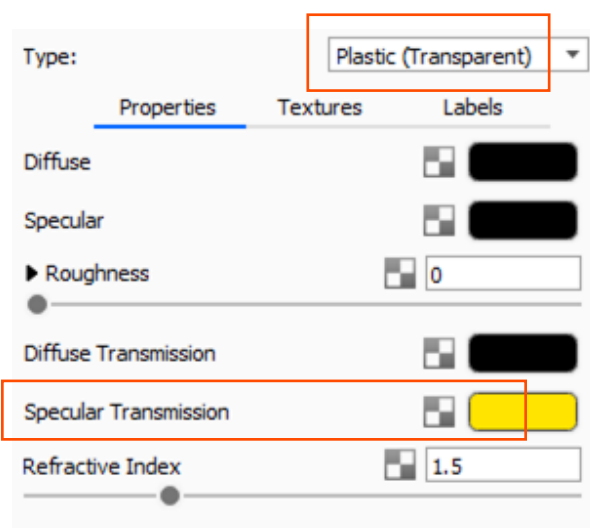


Figure 7: Plastic (Transparent)—Specular Transmission setting

Same Material selected

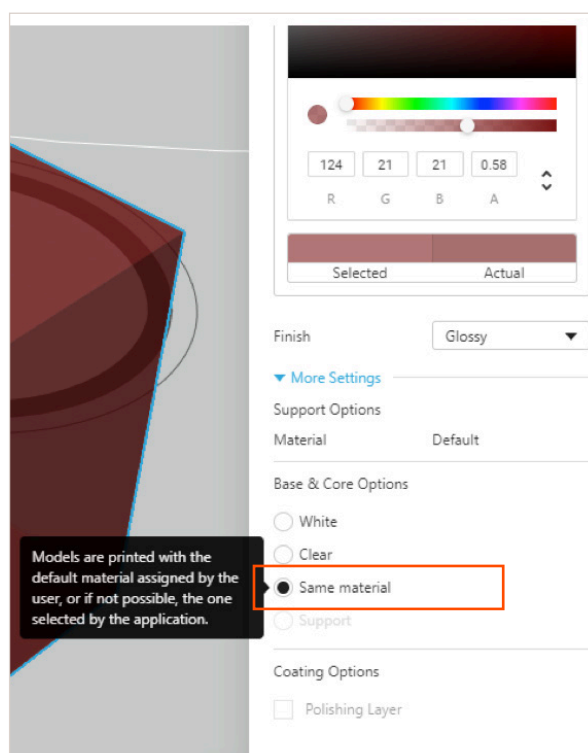
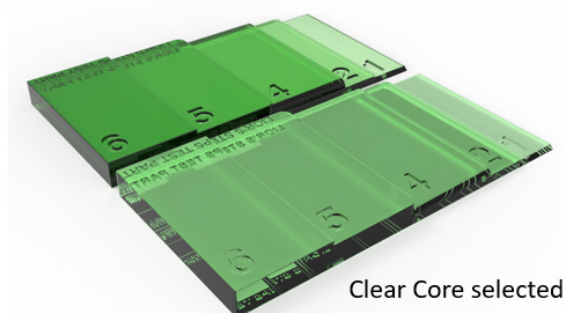


Figure 8: Model with and without Same material applied (left); Same material option in GrabCAD Print (right)

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F. Label Projection

When projecting a label on a model, it may render well in KeyShot; however, if the default settings are used, the label is also mirrored on the back of the model.

In addition, if the model is hollow, the label is visible on the inner side of the wall on which it is projected.

This issue of mirroring, which is less visible and can be entirely hidden in 2D renders, is only apparent in real-life 3D models. To ensure that the label projected on the intended surface only:

- Adjust the *Depth* settings so that it is lower than the thickness of the model.
- Note:** The default depth of 0 is infinite.
- Clear the *Two-sided* check box. This prevents the label from appearing on the back and front of the model and is especially important for hollow and transparent models, as the one shown below.
- When using *Cylindrical projection*, to avoid seeing the label on the inner side of the face, it is recommended to split the surface (in KeyShot or other modelling software). Once the surfaces are split, you can project the label to the desired surface only.
- Add labels directly to the surfaces and not by adding additional surfaces.

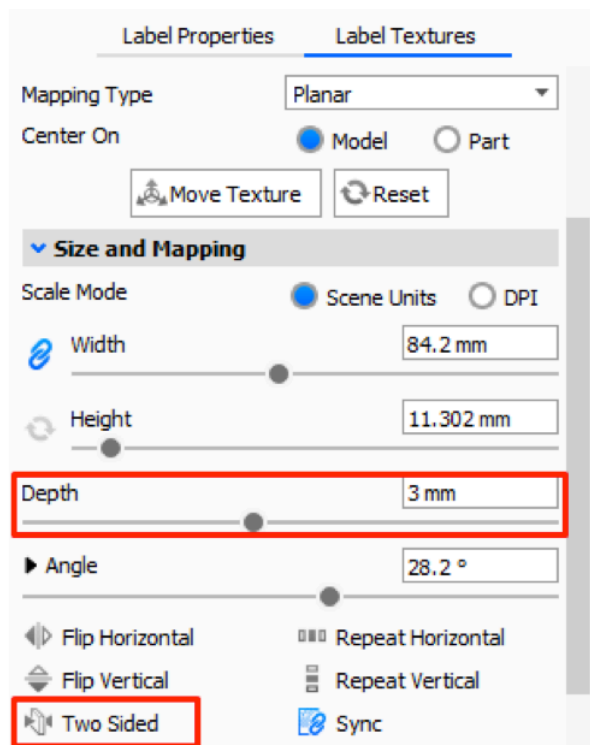


Figure 9: KeyShot Size and Mapping setting



Figure 10: Label on intended surface only (left); Label on front and back of the model (right)

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G. Label and Texture Resolution

For optimal results when adding labels and textures, use a high resolution of between 300 to 600 DPI. It is recommended to enlarge the graphic and make sure that it looks sharp. In 2D renders, low resolution may appear as expected on screen, but when 3D printed, the results are poorer.

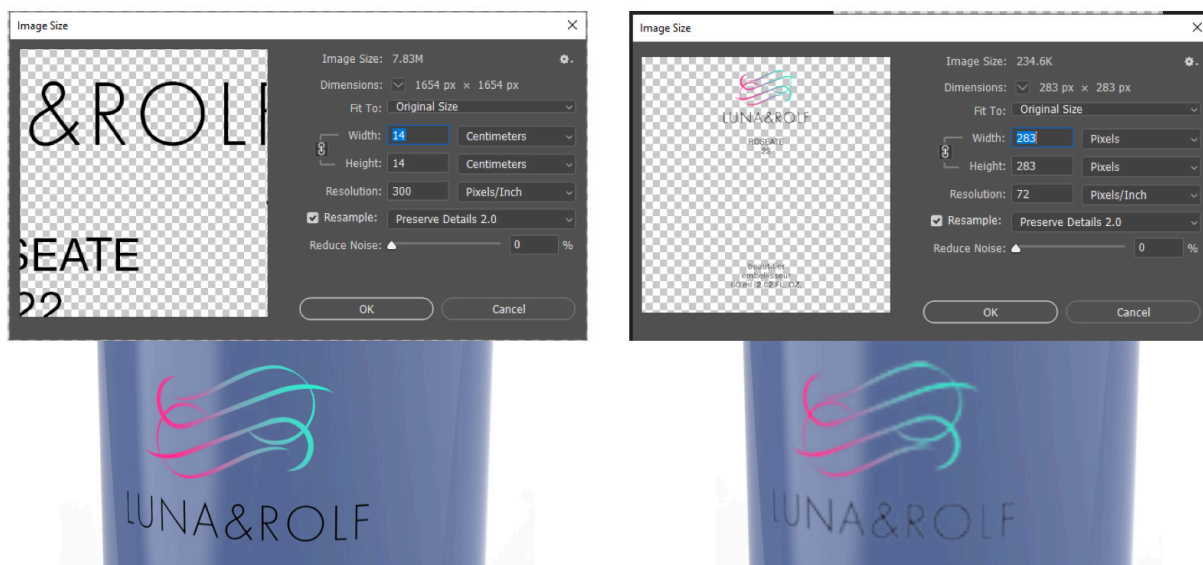


Figure 11: High resolution—text is sharp and clear (left); Low resolution—text is blurry (right)

H. Bump and Displacement

Applying displacement modifies the part geometry and results in changes to the physical model. To avoid this:

- Make sure that you use a wide tolerance. Low tolerances may result in overlapping sections in 3D printing. High tolerances allow for displacement without overlapping.
- Make sure that the tolerance is greater than the displacement height.

Note:

- When using displacement, the mesh is displaced in KeyShot and the overlaps are visible and easy to manipulate.
- When using bump maps, the mesh is displaced during printing, therefore no preview is available.

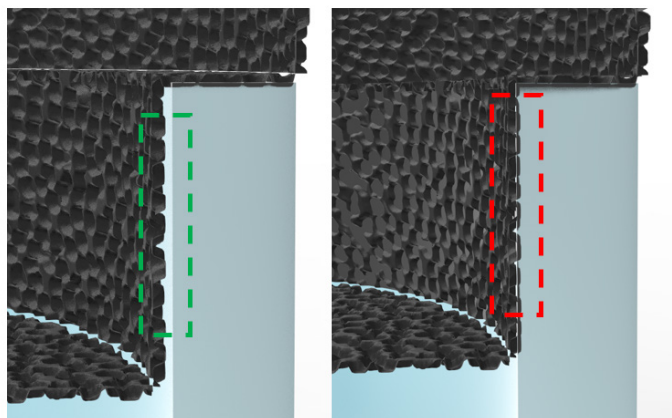


Figure 12: High tolerance results in no overlapping (left); Low tolerance results in overlapping (right)

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I. Additional Resources

Learn more about KeyShot and designing for 3D printing, at the following links:

- KeyShot Tutorials: <https://www.keyshot.com/resources/learning/tutorials/>
- GrabCAD Tutorials: <https://grabcad.com/tutorials>
- Design guides:
 - [Design for Additive Manufacturing with PolyJet Guide](#)
 - [File Preparation for 3D Printing with FDM and PolyJet](#)

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