How to Make a 3D Printed Mask During the COVID-19 Pandemic Printing

Manufacturers from all over the world have begun to use 3D as a means of producing protective masks to support protective personnel during the COVID-19 crisis. Kosta Grammatis and researchers from University of North Carolina have created a step-by-step guide using a conventional FDM 3D printer form Raise3D to create a reusable face mask.

**Step 1: Print and Make Mask**

First, you need to measure the size of your nose and mouth and download the mask .stl file from the case page. You can use the slicing software ideaMaker to adjust the size of the mask. ideaMaker has established a remote connection with Raise3D printer. ideaMaker has built-in a variety of slice templates, which can improve the surface detail and tightness. After the model is printed, you can refer to this case page to test the fit of the mask.

**Step 2: Prepare HEPA Filter**

You need to buy a HEPA filter that blocks a high proportion of 0.3% particles, which already meets the filtering effect of the N95 mask, and cut the filter to fit the size of the mask. You need to carefully remove the filter holder and cut the filter screen. Each mask requires 2.5 inches square of filter material. Check this case page to get the filter purchase page and production method.
Step 3: Install the Filter to Finish the Mask

Place the filter in the mask and press the mask filter into the filter until it is firmly seated. It must be ensured that there is no gap between the filter and the mask. Cut two elastic cords that fit the size of the wearer. Pass each wire through the corresponding mounting hole on the mask. Tie a knot to fix it. Then put the mask on your face and make sure that there is no air leak.

Step 4: Disinfection Methods and Precautions

Research by the National Institutes of Health showed that COVID-19 can survive on plastic for up to 3 days. You can soak the mask components in 70% or higher isopropyl alcohol for 1 minute; 6% or higher sodium hypochlorite (bleach) for 5 minutes. However, the HEPA filter cannot be reused and must be discarded. Therefore, you need to replace the filter regularly.

Before using the mask, you need to blow air inside the mask with your mouth to check the tightness. The material that the mask used is PLA, which cannot be autoclaved, and some chemicals such as acetone can damage the material.

HEPA filters are made of blown glass, which may irritate the lungs, cause asthma, and may cause problems for patients who inhale COVID-19. If irritation or abrasions are caused by rubbing the mask with the face, try applying nexcare tape, or steri tape to the affected area.

FAQ

Q: Why can’t I use T-shirts (or other materials) as a filter?
A: Without proper filters, 3D printed masks are worthless. Viruses such as turbans, shirts, and scarves provide some but very limited protection—especially in hospital settings. The heavy filter material of the HEPA filter is a very fine synthetic polymer fiber mesh, which has the same effect as the N95 mask.

Q: Why do I need to spend so much time to ensure that the mask fits and does not leak air?
A: If a 3D printed mask does not fit, it will not block the virus. Any holes or cracks will allow unfiltered air to enter the wearer’s lungs. The 3D printed mask made of PLA is very hard. We can add an impervious foam strip to the edge of the mask to ensure a good seal.

Q: I don’t have a 3D printer, what should I do?
A: It is recommended that you use Raise3D series printers, such as Raise3D E2 desktop 3D printers, which can achieve the advantages of small-scale customized mass production in small workplaces. E2 printer is equipped with IDEX system, and has duplication/mirror printing mode, which can print multiple model parts at the same time. With the slicing software ideaMaker, and cloud platform RaiseCloud, even in the context of COVID-19, seamless design-production links can be achieved, and personalized masks that fit personal faces can be customized for medical staff.