

# **METHOD OF PRIMING A BUILD MATERIAL PRIOR TO AND DURING THREE-DIMENSIONAL FABRICATION**

## 5 **BACKGROUND OF THE INVENTION**

The present invention is directed to extrusion-based layer deposition systems for building three-dimensional objects. In particular, the present invention relates to the method of which the extrusion head moves prior to  
10 three-dimensional fabrication and during three-dimensional fabrication. Before the three-dimensional fabrication starts, there remains a need for priming the build material in the extrusion head before the three-dimensional fabrication process starts.

15 If the three-dimensional fabrication process is paused to change the build material to a second build material, priming the second build material is essential to maintain high quality of the three-dimensional object.

The method of priming is to extrude a significant amount of build material  
20 from the extrusion head to achieve smooth flow or extrusion from the build head.

Common methods of priming include priming outside the build plate before moving to the build platform to commence three-dimensional fabrication.  
25 The user may use a tweezer or apparatus to separate the extruded build material from the extrusion head and start or continue the three-dimensional fabrication. This exposes the user to dangers from handling parts of the system that are of high temperature and being near moving components.

30 Another common method of priming includes skirting and rafting, which extrudes the build material around the three-dimensional object before depositing the build material in a layer-by-layer manner to form the three-dimensional object. This method is only applicable prior to three-dimensional

fabrication and does not address the issue of changing build material during three-dimensional fabrication.

## SUMMARY OF THE INVENTION

5

The method of priming a build material prior to and during three-dimensional fabrication in the present invention overcomes the disadvantages as briefly set forth above.

10

In accordance to the present invention, a deposit box is attached in the vicinity of the extrusion head and build platform. The deposit box is used to collect extruded build material used during the priming process.

15

The deposit box may be used prior to starting the deposition of the build material in a layer-by-layer manner to form three-dimensional objects. The deposit box may also be used during the deposition of the build material in a layer-by layer-manner to form three-dimensional objects.

20

The use of the deposit box is advantageous as it allows the build material to be primed prior to depositing the build material, which allows the flow of the build material from the extrusion head to be consistent and achieve a high quality three-dimensional object.

25

The deposit box also allocates a dedicated space within the extrusion-based layer deposition system to collect extruded build material used for priming. The dedicated space reduces the amount of extruded build material loose around the extrusion-based layer deposition system and reduces the chances of the extruded build material from getting to critical moving parts or electronic components

30

## DESCRIPTION OF THE DRAWINGS

The invention and the following detailed description of certain embodiments thereof may be understood by reference to the following figures:

Figure 1A is an exemplary diagram of an extrusion-based layer  
5 deposition system.

Figure 1B depicts a cross section of the working area of where the method of priming a build material may occur.

10 Figure 2 depicts a cross section of the working area of where the method of priming a second build material after changing the first build material may occur.

## 15 DETAILED DESCRIPTION

The embodiments will now be described more fully hereinafter. The present invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather,  
20 these embodiments are provided so that this disclosure will convey the scope of the invention to those skilled in the art.

Figure 1A illustrates an exemplary embodiment of an extrusion-based layer deposition system 100.  
25

Additional details of the exemplary embodiment of an extrusion-based layer deposition as illustrated in Figure 1A is described hereinafter. Referring now to Figure 1B, Figure 1B illustrates an exemplary embodiment of a method of priming a build material prior to three-dimensional fabrication. In general, the  
30 extrusion-based layer deposition 100 may comprise of x, y, z linear rails 101, 102 and 103 respectively; an extrusion head 106; a build platform 104; and a deposit box 105.

Prior to three-dimensional fabrication, the extrusion head 106 may be moved to a position above the deposit box 105 through use of the x, y, z linear rails 101, 102, 103 unless the extrusion head 106 is already positioned to the area above the deposit box 105.

5

When priming of the build material starts, the extrusion head 106 will extrude the build material in the extrusion head. Extruding the build material may comprise of heating the build material and applying downward pressure on the build material. The amount of extruded build material may vary in accordance to the user or system settings.

10

The extrusion head 106 is moved from the position above the deposit box 105 to the build platform 104. When the extrusion head 106 is moved, the extruded build material still attached to the extrusion head 106 will be separated by a tab attached to the deposit box 105 by pushing the extrusion head 106 through the tab.

15

Alternatively the tab attached to the deposit box 105 may not be used. Instead, one alternative exemplary embodiment is the use of the top of the deposit box 105 to separate the extruded build material from the extrusion head 106.

20

The deposit box 105 collects the extruded build material that is separated from the extrusion head 106.

25

Referring to Figure 2, an exemplary embodiment of a method of priming a build material during three-dimensional fabrication. Either the user or the extrusion-based layer deposition system may trigger an event to change the build material.

30

The extrusion head 201 will position itself within the area above the deposit box 202. Either the user or the extrusion-based layer deposition system

may change the build material that is in the extrusion head to a second build material.

5       The priming of the build material will start and the extrusion head 201 will extrude the build material in the extrusion head until the second build material is extruded from the extrusion head 201.

10       The extrusion head 201 is moved from the position above the deposit box 202 to the build platform 203. When the extrusion head 201 is moved, the extruded second build material, still attached to the extrusion head 201 will be separated by a tab attached to the deposit box by pushing the extrusion head 201 through the tab.

15       Alternatively the tab may not be used. Instead, one exemplary alternative is the use of the top of the deposit box to separate the extruded build material from the extrusion head 201.

20       The deposit box collects the extruded build material that is separated from the extrusion head 201.

## WHAT IS CLAIMED IS:

1. A method for three-dimensional fabrication with an extrusion-based layer deposition system, the method comprising: positioning the extrusion head within the area above the deposit box; extruding the build material from the extrusion head; and moving the extrusion head from the deposit box to the build platform.
2. The method according to Claim 1, wherein extruding the build material from the extrusion head comprises of melting the build material in the extrusion head.
3. The method according to Claim 2, wherein the extrusion head extrudes the build material within the area above the deposit box.
4. The method according to Claim 3, wherein the extrusion head moves from within the area above the deposit box, to the build platform.
5. The method according to Claim 4, wherein the movement from the extrusion head within the area above the deposit box, to the build platform comprises of pushing the extrusion head through a tab attached to the deposit box.
6. The method according to Claim 5, wherein the deposit box collects the extruded build material from the extrusion head when the extrusion head pushes through the tab attached to the deposit box.
7. The method according to Claim 6, wherein the extrusion head pushes through the tab attached to the deposit box, from the deposit box to the build platform, the extruded build material is separated from the extrusion head.
8. The method according to Claim 7, for use in the beginning of three-dimensional fabrication and before the extrusion head moves into the build

platform, depositing the build material in a layer-by-layer manner to form three-dimensional objects.

9. The method according to Claim 7, for use in changing the first build material to a second build material during three-dimensional fabrication.

10. The method according to Claim 9, wherein extruding the first build material in the extrusion head transitions to the second build material in the extrusion head.

11. The method according to Claim 10, wherein the second build material is the same material as the first build material.

12. The method according to Claim 10, wherein the second build material is a different material from the first build material.

13. The method according to Claim 10, wherein the changing of the first build material to a second build material during three-dimensional fabrication is initiated by the user during the three-dimensional fabrication.

14. The method according to Claim 10, wherein the changing of the first build material to a second build material during three-dimensional fabrication is initiated by the extrusion-based layer deposition system.

15. The method according to Claim 6, wherein the tab comprises of an elastomer type polymer.

16. The method according to Claim 6, wherein the tab comprises of an elastomer type silicone polymer.

17. The method according to Claim 6, wherein the tab comprises of an elastomer type rubber polymer.

18. The method according to Claim 4, wherein the movement from the extrusion head within the area above the deposit box, to the build platform comprises of the extrusion head moving from the deposit box to the build platform.
19. The method according to Claim 18, wherein the deposit box collects the extruded build material from the extrusion head when the extrusion head passes through the deposit box.
20. The method according to Claim 19, wherein the extrusion head moving from the deposit box to the build platform, the extruded build material is separated from the extrusion head.
21. The method according to Claim 20, wherein the distance between the extrusion head and the top of the deposit box is between 0.01mm to 5mm.
22. The method according to Claim 20, for use in the beginning of three-dimensional fabrication and before the extrusion head moves into the build platform, depositing the build material in a layer-by-layer manner to form three-dimensional objects.
23. The method according to Claim 20, for use in changing the first build material to a second build material during three-dimensional fabrication.
24. The method according to Claim 23, wherein extruding the first build material in the extrusion head transitions to the second build material in the extrusion head.
25. The method according to Claim 24, wherein the second build material is the same material as the first build material.
26. The method according to Claim 24, wherein the second build material is a different material from the first build material.

27. The method according to Claim 24, wherein the changing of the first build material to a second build material during three-dimensional fabrication is initiated by the user during the three-dimensional fabrication.

28. The method according to Claim 24, wherein the changing of the first build material to a second build material during three-dimensional fabrication is initiated by the extrusion-based layer deposition system.