BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views and which together with the detailed description below are incorporated in and form part of the specification, serve to illustrate various embodiments and to explain various principles and advantages in accordance with present embodiments.

[0012] FIG. 1, comprising FIGs. 1A, 1B and 1C, depicts illustrations of systems for three-dimensional (3D) printing in accordance with a present embodiment wherein FIG. 1A depicts a cross-sectional planar view of the system for using a light source for an optical image source, FIG. 1B depicts a cross-sectional planar view of the system for using a laser beam for the optical image source, and FIG. 1C depicts a cross-sectional planar view of the system when not using a screen.

[0013] FIG. 2 depicts a side planar view of a support fluid reservoir and print tank system in accordance with the present embodiment.

[0014] And FIG. 3, comprising FIGs. 3A and 3B, depicts illustrations of 3D closed contour print outs in accordance with the present embodiment wherein FIG. 3A depicts disadvantages of a solid print bed and FIG. 3B depicts a print bed in accordance with the present embodiment.

[0015] Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been depicted to scale.

DETAILED DESCRIPTION

[0016] The following detailed description is merely exemplary in nature and is not intended to limit the invention or the application and uses of the invention.

CLAIMS

What is claimed is:

1. A system for printing a three-dimensional (3D) object comprising:

a resin tank wherein the 3D object is printed, the resin tank including a print bed to form a base of the 3D object;

an optical image source for modulating light in accordance with a 3D image to vary a degree and pattern of crosslinking in a photocrosslinkable resin in the resin tank;

a support fluid reservoir comprising a support fluid which is immiscible with the photocrosslinkable resin, wherein the support fluid reservoir is in fluid communication with the resin tank; ~~and~~

a pumping structure configured to transfer the support fluid from the support fluid reservoir to the resin tank such that the support fluid rises in the resin tank at a same rate as vertical height of a top of the 3D object as the 3D object is printed on the print bed; and

a vertically displaceable screen setting on top of the photocrosslinkable resin in the resin tank,

wherein the pumping structure is configured to transfer the support fluid from the support fluid reservoir to the resin tank such that the support fluid rises in the resin tank at a same rate as vertical displacement of the vertical displaceable screen away from the print bed.

2. The system in accordance with Claim 1 wherein the support fluid constrictably maintains a crosslinkable layer of the photocrosslinkable resin against the screen for continuously forming a part of the 3D object.

3. The system in accordance with Claim 2 wherein the support fluid maintains the crosslinkable layer against the screen until the 3D object is completely printed.

4. The system in accordance with any of the preceding claims wherein the optical image source comprises:

a light source; and

a mask disposed between the light source and the resin tank for modulating light from the light source to vary the degree and pattern of crosslinking in the photocrosslinkable resin.

5. The system in accordance with Claim 4 wherein the mask comprises the vertically displaceable screen.

6. The system in accordance with either Claim 4 or Claim 5 wherein the mask is an active matrix.

7. The system in accordance with Claim 6 wherein the active matrix is a liquid crystal display panel.

8. The system in accordance with any of Claims 1 to 3 wherein the optical image source comprises:

laser illumination; and

a liquid-crystal-on-silicon configuration.

9. The system in accordance with any of the preceding claims wherein the vertically displaceable screen comprises a glass plate coated with polydimethylsiloxane (PDMS) to prevent the photocrosslinkable resin from adhering to the glass plate.

10. The system in accordance with any of the preceding claims wherein the photocrosslinkable resin comprises a resin or a gel or an initiator system which is sensitive to particular light wavelengths.

11. The system in accordance with Claim 10 wherein the photocrosslinkable resin comprises one or more of H-Nu 605IL initiator which is sensitive to red illumination, Eosin Y/TEA/NVP initiator system which is sensitive to green illumination or ZVE200-V470 resin which is sensitive to blue illumination.

12. The system in accordance with any of the preceding claims wherein the support fluid comprises oxygen for limiting a thickness of the photocrosslinkable resin by creating a depletion zone within the photocrosslinkable resin.

13. The system in accordance with Claim 12 wherein the support fluid comprises an oil denser than the resin.

14. The system in accordance with Claim 13 wherein the oil comprises perfluorinated an oil with surfactant or semifluorinated oil with surfactant.

15. The system in accordance with any of the preceding claims wherein the print bed is chemically modified for adhesion of the 3D object.

16. The system in accordance with any of the preceding claims wherein the print bed has a plurality of channels formed therein.

17. A method for continuous printing of a three-dimensional (3D) object comprising:

modulating light projected from an optical image source through a vertically displaceable screen to vary the degree and pattern of crosslinking in a photocrosslinkable resin placed in a resin tank as the vertically displaceable screen is displaced away from a print bed in the resin tank; and

transferring a support fluid from a support fluid reservoir to the resin tank such that the support fluid rises in the resin tank at a same rate as the vertically displaceable screen is vertically displaced away from the print bed.

18. The method in accordance with Claim 17 wherein transferring the support fluid comprises transferring the support liquid to constrictably maintain a crosslinkable layer of the photocrosslinkable resin against the screen for continuously forming a part of the 3D object.

19. The method in accordance with either Claim 17 or Claim 18 wherein transferring the support fluid comprises transferring the support liquid until the 3D object is completely printed.