possibly used in conjunction with the prior application, the device may also be used under zero gravity to handle liquid samples in space.

[0018] In yet another embodiment, the invention is a microfluidic device comprising a photoresist exposed to UV light through a binary transparency mask including an optical adhesive with low contrast $\gamma \approx 0.55$ to promote partial polymerization in areas subject to diffracted light and to facilitate the transfer of discrete patterns from the mask as homogeneous patterns (smooth surfaces) to the photoresist.

[0019] The device may comprise semicircular microchannels generated by using swatches of 5×1 pixels that are enlarged with graphic-design software to form lines. Additionally, complex curved surfaces in a microchannel may be created with graphic software operations such as stretching, rotating and skewing.

[0020] The device may further comprise a second microchannel of a smaller diameter that is semi-circular and includes a semi-spiral ridge inside. Microchannels may also have a zigzag structure that is modulated in an x, y and z direction.

[0021] These, and other aspects and objects of the present invention will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following description, while indicating preferred embodiments of the present invention, is given by way of illustration and not of limitation. Many changes and modifications may be made within the scope of the present invention without departing from the spirit thereof, and the invention includes all such modifications.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] A clear conception of the advantages and features constituting the present invention, and of the construction and operation of typical mechanisms provided with the present invention, will become more readily apparent by referring to the exemplary, and therefore non-limiting, embodiments illustrated in the drawings accompanying and forming a part of this specification, wherein like reference numerals designate the same elements in the several views, and in which:

[0023] FIG. **1** is an illustration of morphology transition in an array of swatches of different pixels size and density;

[0024] FIG. **2** and the FIG. **3** illustrate various shapes produced;

[0025] FIG. **4** illustrates various grayscale tones in swatches which may be used;

[0026] FIG. **5** is a schematic illustrating fabrication of a master template;

[0027] FIG. **6** shows one embodiment of a microfluidic device of the present invention;

[0028] FIG. **7** is a close-up of a microchannel of the device shown in FIG. **6**;

[0029] FIG. **8** is a grayscale pattern used to create the microchannel shown in FIG. **7**;

[0030] FIG. **9** is a swatch used to create the grayscale pattern of FIG. **8**;

[0031] FIGS. **10** and **11** are schematics of side channels of the device shown in FIG. **6**;

[0032] FIGS. **12**A and **12** B illustrate fluid flow in the device shown in FIG. **6**;

[0033] FIG. **13** is a partial view of a grayscale pattern used to create a microfluidic device of the present invention;

[0034] FIG. **14** is a swatch used to create the grayscale pattern of FIG. **13**;

[0035] FIG. **15** is a partial close-up view of microchannels of the device created using the grayscale shown in FIG. **13**;

[0036] FIGS. **16**A-**17** B illustrate other grayscale patterns and the shapes may form;

[0037] FIG. **18** shows a partial view T-shaped microchannel of the present invention;

[0038] FIG. **19** shows a close up of a zigzag section of microchannel of the present invention;

[0039] FIG. **20** is a partial view of a grayscale used to create the microchannel of FIG. **19**;

[0040] FIG. **21** is a swatch used to create the grayscale pattern of FIG. **20**;

[0041] FIG. **22** shows a close-up of a concentric circle pattern of the present invention;

[0042] FIG. **23** is a pixelated grayscale pattern of FIG. **22**;

[0043] FIG. **24** is a horn created using the pattern shown in the FIG. **23**;

[0044] FIG. **25**A is a master template of horns like the one shown in FIG. **24**;

[0045] FIG. **25**B shows a method of creating an ejector plate from the template shown in FIG. **25**A;

[0046] FIG. **26** shows an ejector device of the present invention;

[0047] FIG. **27**A is an illustration showing an ejector device in operation;

[0048] FIG. **27**B is a photograph showing that ejector device of the present invention in operation;

[0049] FIG. **28** is a diagram showing the various pixel patterns and swatches that may be used to develop various microstructures of the present invention;

[0050] FIG. **29** is another diagram showing the various masks with pixel patterns that may be used to develop various microstructures of the present invention;

[0051] FIGS. **30** and **31** show a master template of a microstructure of the present invention;

[0052] FIGS. **32** and **33** show replicas created from the template shown in FIGS. **30** and **31**; and

[0053] FIG. **34** is a graph showing a calculation of the present invention.

[0054] In describing the preferred embodiment of the invention that is illustrated in the drawings, specific terminology will be resorted to for the sake of clarity. However, it is not intended that the invention be limited to the specific terms so selected and it is to be understood that each specific term includes all technical equivalents that operate in a similar manner to accomplish a similar purpose. For example, the words "connected", "attached", or terms similar thereto are often used. They are not limited to direct connection but include connection through other elements where such connection is recognized as being equivalent by those skilled in the art.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0055] The present invention and the various features and advantageous details thereof are explained more fully with reference to the non-limiting embodiments described in detail in the following description.

1. System Overview

[0056] In the method of the present invention, first a glass slide is brought into contact with an optical adhesive of a