CLAIMS:

1. A method for manufacturing one or more optical arrays, the method comprising:

(A) providing a substrate comprising a first polymer layer sensitive to a radiation;

(B) providing a single mask comprising a first mask portion configured to block the radiation and one or more second mask portions configured to allow the radiation to pass through, wherein each second mask portion in the one or more second mask portions has a first dimension in a first direction and a second dimension in a second direction, wherein the second direction is different from the first direction;

(C) positioning the substrate and the mask relative to each other at each relative position in a first plurality of relative positions along the first direction, wherein a distance between adjacent relative positions in the first plurality of relative positions is equal to or less than the first dimension of any second mask portion in the one or more second mask portions;

(D) exposing, at each respective relative position in the first plurality of relative positions, the first polymer layer through the mask to a corresponding dose in a first plurality of doses of the radiation, thereby producing one or more first exposed polymer portions in the first polymer layer;

(E) positioning the substrate and the mask relatively to each other at each relative position in a second plurality of relative positions along the second direction, wherein a distance between adjacent relative positions in the second plurality of relative positions is equal to or less than the second dimension of any second mask portion in the one or more second mask portions; and

(F) exposing, at each respective relative position in the second plurality of relative positions, the first polymer layer through the mask to a corresponding dose in a second plurality of doses of the radiation, thereby producing one or more second exposed polymer portions in the first polymer layer;

wherein each respective second exposed polymer portion in the one or more second exposed polymer portions overlaps at least partially with each corresponding first exposed polymer portion in the one or more first portions, thereby producing one or more overlapped exposed polymer portions, each overlapped exposed polymer portion creates an array of dosed segments, wherein each dosed segment in the array of dosed segments is exposed to a different dose of the radiation.

2. The method of claim 1, wherein a distance between any two relative positions in the first plurality of relative positions is equal to or less than the first dimension of any second mask portion in the one or more second mask portions, or a distance between any two relative positions in the second plurality of relative positions is equal to or less than the second dimension of any second mask portion in the one or more second mask portions.

3. The method of claim 1 or 2, further comprising:

(G) developing the first polymer layer of the substrate such that of each overlapped or final exposed polymer portion, each dosed segment in the array of dosed segments is developed to produce a first surface at a different depth in the first polymer layer, thereby creating one or more patterned structures in the first polymer layer of the substrate, each patterned structure comprising an array of first surfaces at different depths.

4. The method of claim 3, wherein of a respective patterned structure in the one or more patterned structures, the depths of the array of first surfaces range from 0 to 2 μm, from 0 to 5 μm, from 0 to 10 μm, from 0 to 15 μm, from 0 to 20 μm, from 0 to 25 μm, , from 0 to 30 μm, from 0 to 50 μm, or from 0 to 100 μm.

5. The method of any one of claims 3-4, wherein of a respective patterned structure in the one or more patterned structures, at least two depths of the array of first surfaces differ from each other by at least two orders of magnitude, or by at least three orders of magnitude.

6. The method of any one of claims 3-5, further comprising:

(H) depositing a layer of a first reflective material on top of the one or more patterned structures.

7. The method of claim 6, wherein the layer of the first reflective material comprises a semi-transparent aluminum film having a thickness of between 5 and 10 nm, between 10 and 15 nm, between 15 and 20 nm, between 20 and 25 nm, or between 25 and 30 nm.

8. The method of any one of claims 6-7, further comprising:

(I) overlaying a first protection layer on the layer of the first reflective material.

9. The method of claim 8, wherein the first protection layer is made of a material comprising silicon dioxide (SiO_2).

10. The method of any one of claims 8-9, further comprising:

(J) overlaying a second protection layer on the first protection layer.

11. The method of claim 10, wherein the second protection layer is made of a material comprising a polymer.

12. The method of any one of claims 6-11, further comprising:

(K) dicing the substrate to produce one or more individual chips, each comprising a patterned structure in the one or more patterned structures.

13. The method of any one of claims 6-12, wherein the substrate comprises a glass substrate coated with a layer of second reflective material, wherein the first polymer layer overlays the layer of second reflective material, wherein corresponding to each of the one or more patterned structures, an optical array is formed by the second reflective layer, a first reflective layer formed by the layer of first reflective material, and the first polymer layer in-between.

14. The method of claim 13, wherein the first polymer layer comprises a Poly(methyl methacrylate) (PMMA) film spun on top of the coated glass substrate.

15. The method of any one of claims 13-14, wherein the layer of second reflective material comprises a semi-transparent aluminum film having a thickness of between 5 and 10 nm, between 10 and 15 nm, between 15 and 20 nm, between 20 and 25 nm, or between 25 and 30 nm.

16. The method of any one of claims 13-15, further comprising:

(L) attaching a sensor array above or under each of the one or more patterned structures, wherein the sensor array is configured to detect light transmitted through the optical array, wherein the attaching (L) is performed prior to or subsequent to the dicing (K).

17. The method of any one of preceding claims, wherein the radiation comprises an X-ray beam, or a UV beam.

18. The method of any one of the preceding claims, wherein the first polymer layer has a thickness between 2 and 5 µm, between 5 and 10 µm, between 10 and 15 µm, between 15 and 20 µm, between 20 and 30 µm, between 30 and 50 µm, or between 50 and 100 µm.

19. The method of any one of the preceding claims, wherein the first and second directions are substantially perpendicular to each other.

20. The method of any one of the preceding claims, wherein each second mask portion in the one or more second mask portions has characteristic dimensions of between 0.001 x 0.001 and 0.1 x 0.1 mm^2, between 1 x 1 and 1.5 x 1.5 mm^2, between 1.5 x 1.5 and 2x2 mm^2, between 2 x 2 and 2.5 x 2.5 mm^2, or between 2.5 x 2.5 and 3 x 3 mm^2.

21. The method of any one of the preceding claims, wherein the one or more second mask portions comprises between 10 and 50 second mask portions, between 50 and 100 second mask portions, between 100 and 150 second mask portions, between 150 and 200 second mask portions, between 200 and 300 second mask portions, between 300 and 400 second mask portions, between 400 and 500 second mask portions, between 1000 and 2000 second mask portions, between 2000 and 5000 second mask portions, or between 5000 and 10000 second mask portions wherein each second mask portion is spatially separated from another.

22. The method of claim 21, wherein at least two second mask portions have a same configuration.

23. The method of any one of claims 21-22, wherein at least two second mask portions have different configurations.

24. The method of any one of preceding claims, wherein the first relative position in the second plurality of relative positions coincides with the first relative position in the first plurality of relative positions.

25. The method of any one of preceding claims, wherein the positioning (C) is performed stepwise and successively along the first direction.

26. The method of any one of preceding claims, wherein the positioning (E) is performed stepwise and successively along the second direction.

27. The method of any one of the preceding claims, wherein the positioning (E) is performed prior to or subsequent to the positioning (C).

28. The method of any one of the preceding claims, wherein at least two first distances are the same as each other, wherein a first distance is a distance between two adjacent relative positions in the first plurality of relative positions.

29. The method of any one of the preceding claims, wherein at least two first distances are different from each other, wherein a first distance is a distance between two adjacent relative positions in the first plurality of relative positions.

30. The method of any one of the preceding claims, wherein at least two second distances are the same as each other, wherein a second distance is a distance between two adjacent relative positions in the second plurality of relative positions.

31. The method of any one of the preceding claims, wherein at least two second distances are different from each other, wherein a second distance is a distance between two adjacent relative positions in the second plurality of relative positions.

32. The method of any one of the preceding claims, wherein at least two doses in the first plurality of doses are the same as each other.

33. The method of any one of the preceding claims, wherein at least two doses in the first plurality of doses are different from each other.

34. The method of any one of the preceding claims, wherein at least two doses in the second plurality of doses are the same as each other.

35. The method of any one of the preceding claims, wherein at least two doses in the second plurality of doses are different from each other.

36. The method of any one of the preceding claims, wherein the first plurality of relative positions along the first direction comprises between 10 and 200 relative positions, between 200 and 500 relative positions, or between 500 and 1000 relative positions.

37. The method of any one of the preceding claims, wherein the second plurality of relative positions along the first direction comprises between 10 and 200 relative positions, between 200 and 500 relative positions, or between 500 and 1000 relative positions.

38. A system, comprising:

at least one processor and memory addressable by the at least one processor, the memory storing at least one program for execution by the at least one processor, the at least one program comprising instructions for performing the method of any one of claims 1-37.