CLAIMS

1. A method of fabricating a photonic structure on a surface of a solid substrate including a first material, the method comprising:

depositing a deformable layer of the first material onto the surface of the solid substrate;

embossing the deformable layer with a mold bearing a photonic structure pattern and an optically modifying layer;

solidifying the deformable layer to be integral with the surface of the solid substrate with the mold in place to form permanent photonic structures in the solidified layer; and

removing the mold from the deformable layer,

wherein the optically modifying layer of the mold is transferred to the deformable layer upon embossing and is operative to affect optical properties of the photonic structure pattern on the surface of the solid substrate having the solidified deformable layer, and

wherein the solidifying step comprises one or more of crystallization, solvent evaporation, vitrification, a magnetorheological transition, and condensation.

2. The method of claim 1, wherein the photonic structure includes periodic features arranged along at least one dimension.

3. The method of claim 2, wherein the periodic features form a diffraction grating.

4. The method of claim 2, wherein the periodic features are arranged in two dimensions.

5. The method of claim 1, wherein the deformable layer is deposited in one of a fluid, semi-viscous or viscous form at a time the layer is deposited onto the substrate.

6. The method of claim 5, wherein the first material includes a polymer resin.

7. The method of claim 6, wherein the deformable layer is selected to have a viscosity at atmospheric temperature sufficiently low to be embossed using a PDMS mold.

8. The method of claim 7, wherein the deformable layer has a viscosity ranging from 100 to 5000 cP at the time the resin is deposited on the substrate.

9. The method of claim 1, wherein the mold is composed of polydimethylsiloxane (PDMS).

10. The method of claim 1, wherein the solidified layer forms cross-links with the first material of surface of the substrate.

11. The method of claim 1, further comprising:

adding an anti-adhesion layer to the mold prior to embossing to prevent adhesion between the mold and at least one of the optically modifying layer and the solidified layer of the first material.

12. The method of claim 11, wherein the anti-adhesion layer comprises a monolayer.

13. The method of claim 1, further comprising:

adding a layer to the deformable layer prior to embossing to modify properties of the deformable layer upon solidification.

14. The method of claim 13, wherein the added layer comprises a protective coating.

15. The method of claim 13, wherein the added layer modifies optical properties of the photonic structure.

16. A method of fabricating a photonic structure on a surface of a solid substrate, the method comprising:

depositing a deformable layer onto the surface of the solid substrate;

embossing the deformable layer with a mold bearing a photonic structure pattern and an optically modifying layer;

solidifying the deformable layer to be integral with the surface of the solid substrate with the mold in place to form permanent photonic structures in the solidified layer; and

removing the mold from the deformable layer,

wherein the optically modifying layer of the mold is transferred to the deformable layer upon embossing and is operative to affect optical properties of the photonic structure pattern on the surface of the solid substrate having the solidified deformable layer, and

wherein the deformable layer forms cross-linking bonds with the substrate during solidification so as to firmly embed the solidified layer in the substrate, and

wherein the solidifying step comprises one or more of crystallization, solvent evaporation, vitrification, a magnetorheological transition and condensation.

17. A photonic structure formed on a surface of a solid substrate which includes a first material by performing the steps comprising:

depositing a deformable layer of the first material onto the surface of the solid substrate;

embossing the deformable layer with a mold bearing a photonic structure pattern and an optically modifying layer;

solidifying the deformable layer to be integral with the surface of the solid substrate with the mold in place to form permanent photonic structures in the solidified layer; and

removing the mold from the deformable layer,

wherein the optically modifying layer of the mold is transferred to the deformable layer upon embossing and is operative to affect optical properties of the photonic structure pattern on the surface of the solid substrate having the solidified deformable layer, and

wherein the solidifying step comprises one or more of crystallization, solvent evaporation, vitrification, and a magnetorheological transition and condensation.

18. A photonic structure formed on a surface of a solid substrate by performing the steps comprising:

depositing a deformable layer onto the surface of the solid substrate;

embossing the deformable layer with a mold bearing a photonic structure pattern and an optically modifying layer;

solidifying the deformable layer to be integral with the surface of the solid substrate with the mold in place to form permanent photonic structures in the solidified layer; and

removing the mold from the deformable layer;

wherein the optically modifying layer of the mold is transferred to the deformable layer upon embossing and is operative to affect optical properties of the photonic structure pattern on the surface of the solid substrate having the solidified deformable layer, and

wherein the deformable layer forms cross-linking bonds with the substrate during solidification so as to firmly embed the solidified layer in the substrate, and

wherein the solidifying step comprises one or more of crystallization, solvent evaporation, vitrification, and a magnetorheological transition and condensation.

19. The method of claim 1, wherein the deformable layer and the substrate are made of the same material.