CLAIMS

What is claimed is:

1. A photonics structure, comprising:

a photonics dielectric stack on a substrate, the photonics dielectric stack including a dielectric layer and one or more photonics devices having a photosensitive material formation;

a first dielectric material layer with a first portion thereof formed over the photosensitive material formation, and a second portion thereof formed over the dielectric layer of the dielectric stack;

an etch stop layer over the first dielectric material layer; and

a second dielectric material layer over the etch stop layer, the second dielectric material layer including an etched trench over the photosensitive material formation, the etched trench extending through the etch stop layer and the first dielectric material layer, wherein a bottom of the trench is delimited by the photosensitive material formation, and wherein a continuous sidewall of the trench extends through elevations of the etch stop layer and the first dielectric material layer.

2. The photonics structure of claim 1, wherein the etched trench is formed by plasmaless etching.

3. The photonics structure of any one of claims 1, 2, 34-36, wherein the photosensitive material formation is germanium.

4. The photonics structure of any one of claims 1, 2, 34-36, wherein the etch stop layer is patterned to include a truncated length for preventing coupling of light signal propagating within the photonics structure to the etch stop layer.

5. The photonics structure of any one of claims 1, 2, 34-36, further including an aluminum deposit within the trench having a planarized top surface thereof.

6. The photonics structure of claim 5, further including a metallization layer formation over the aluminum deposit and in electrical communication therewith.

7. The photonics structure of claim 6, further including a termination metallization layer formation at an elevation higher than an elevation of the metallization layer formation, the

termination metallization layer formation in electrical communication with the metallization layer.

8. A photonics structure, comprising:

a photonics dielectric stack on a substrate and including a dielectric layer, the photonics dielectric stack including one or more photonics devices having a photosensitive material formation;

a first dielectric material layer with a first portion thereof formed over the photosensitive material formation, and a second portion thereof formed over the dielectric layer of the dielectric stack;

an etch stop layer over the first dielectric material layer;

a second dielectric material layer on the etch stop layer, the second dielectric material layer including an etched trench over the photosensitive material formation such that a bottom of the trench is delimited by the photosensitive material formation, the trench further including an upper region of wider diameter and a lower region of narrower diameter, the trench further including an aluminum deposit including a top surface thereof that is atomically smooth and planar, the trench delimited by the dielectric layer of the photonics dielectric stack.

9. The photonics structure of claim 8, the photonics structure further including a waveguide having a bottom elevation thereof that is higher than an elevation of the planar top surface of the aluminum deposit.

10. The photonics structure of claim 9, further including:

one or more dielectric layers over the planar top surface;

a layer of waveguiding material over the one or more dielectric layers patterned such that the layer of waveguiding material defines a waveguide.

11. The photonics structure of claim 8, wherein ~~the~~ waveguiding material is patterned to define a waveguide ~~formed by~~ occupying a range of elevations between the upper region and lower region of the trench.

12. The photonics structure of claim 8, further including a barrier layer, and wherein the trench is formed from etching through the barrier layer.

13. The photonics structure of claim 1, wherein the photosensitive material formation occupies a range of elevations, and wherein the dielectric layer extends at an elevation within the range of elevations.

14. The photonics structure of any one of claims 1, 13, 34-36, wherein an entirety of a top elevation of the dielectric layer extends horizontally.

15. The photonics structure of any one of claims 1, 13-14, 34-36, wherein a bottom elevation of the first dielectric material layer is above a top elevation of the photosensitive material formation.

16. The photonics structure of any one of claims 1, 13–15, 34-36, wherein an entirety of the first dielectric material layer is formed above a top elevation of the photosensitive material formation.

17. The photonics structure of any one of claims 1, 13–16, 34-36, wherein the photosensitive material formation comprises a semiconductor ion implantation region, and wherein the bottom of the trench is delimited by semiconductor material of the ion implantation region.

18. The photonics structure of any one of claims 1, 13–17, 34-36, wherein the photosensitive material formation comprises a semiconductor ion implantation region, wherein the bottom of the trench is delimited by semiconductor material of the ion implantation region, and wherein the ion implantation region is spaced apart from dielectric material delimiting the photosensitive material formation.

19. The photonics structure of any one of claims 1, 13–18, 34-36, wherein the trench includes a center axis.

20. The photonics structure of any one of claims 1, 13–19, 34-36, wherein the trench includes a continuous sidewall.

21. The photonics structure of any one of claims 1, 13–20, 34-36, further comprising an aluminum deposit within the trench, the aluminum deposit having a planarized top surface co-defined by the second dielectric material layer and the aluminum deposit.

22. The photonics structure of any one of claims 1, 13–21, 34-36, wherein the etch stop layer is patterned such that the etch stop layer includes a truncated length in substantial alignment with the photosensitive material formation to prevent coupling of a light signal propagating within the photonics structure to the etch stop layer.

23. The photonics structure of any one of claims 1, 13–21, 34, 36, wherein the etch stop layer is configured to include a truncated length such that lateral ends of the etch stop layer terminate substantially above opposite edges of the photosensitive material formation.

24. The photonics structure of any one of claims 1, 13–21, 34-35, wherein the etch stop layer is configured such that left and right ends of the etch stop layer are substantially aligned above, respectively, left and right sections of the photosensitive material formation to reduce optical coupling.

25. The photonics structure of any one of claims 1, 13–21, 34-36, wherein the etch stop layer is configured to include a truncated length in substantial alignment with the photosensitive material formation for optical isolation relative to at least one of the one or more photonics devices included in the photonics dielectric stack.

26. The photonics structure of any one of claims 1, 13–21, 34-36, wherein the etch stop layer is configured to include a truncated length in substantial alignment with the photosensitive material formation for optical isolation relative to a light signal propagating within the photonics structure.

27. The photonics structure of any one of claims 1, 13–21, 34-36, wherein the etch stop layer is localized ~~about~~ and aligned above the photonics material formation for optical isolation.

28. The photonics structure of any one of claims 1, 13-21, 34-36, wherein the trench includes a center axis and continuous sidewalls aligned with the photosensitive material formation.

29. A method comprising:

depositing a layer of dielectric material so that a first portion of the layer of dielectric material is formed on a photosensitive material formation and so that a second portion of the layer of dielectric material is formed on a dielectric layer of a dielectric stack of a photonics structure having one or more photonics device;

depositing an etch stop layer on the layer of dielectric material;

forming a dielectric material layer on the etch stop layer;

performing first etching of the dielectric material layer selective to the etch stop layer to define a trench over the photosensitive material formation;

performing second etching of the etch stop layer, wherein the second etching removes material of the etch stop layer through a thickness of the etch stop layer and material of the layer of dielectric material through a portion of a thickness of the layer of dielectric material, the second etching increasing a depth of the trench; and

performing plasmaless etching of a remaining thickness of the layer of dielectric material to reveal the photosensitive material formation so that a bottom of the trench is delimited by the photosensitive material formation.

30. The method of claim 29, wherein the performing plasmaless etching includes performing of a remote plasmaless etch.

31. The method of claim 29, wherein the removing of the material of the layer of dielectric material includes performing of a remote plasmaless etch that is selective to germanium.

32. The method of claim 29, wherein the method includes patterning the etch stop layer to prevent a light signal propagating within the photonics structure from coupling with the etch stop layer.

33. The photonics structure of any one of claims 1, 13-21, 34-36, wherein a vertically extending center axis of the trench extends centrally through an etch stop layer portion of the trench, and centrally through a first dielectric material layer portion of the trench.

34. A photonics structure, comprising:

a photonics dielectric stack on a substrate, the photonics dielectric stack including a dielectric layer and one or more photonics devices having a photosensitive material formation;

a first dielectric material layer with a first portion thereof formed over the photosensitive material formation, and a second portion thereof formed over the dielectric layer of the dielectric stack;

an etch stop layer over the first dielectric material layer; and

a second dielectric material layer over the etch stop layer, the second dielectric material layer including an etched trench over the photosensitive material formation, the etched trench extending through the etch stop layer and the first dielectric material layer, wherein a bottom of the trench is delimited by the photosensitive material formation, wherein the etched trench is formed by plasmaless etching.

35. A photonics structure, comprising:

a photonics dielectric stack on a substrate, the photonics dielectric stack including a dielectric layer and one or more photonics devices having a photosensitive material formation;

a first dielectric material layer with a first portion thereof formed over the photosensitive material formation, and a second portion thereof formed over the dielectric layer of the dielectric stack;

an etch stop layer over the first dielectric material layer; and

a second dielectric material layer over the etch stop layer, the second dielectric material layer including an etched trench over the photosensitive material formation, the etched trench extending through the etch stop layer and the first dielectric material layer, wherein a bottom of the trench is delimited by the photosensitive material formation, wherein the etch stop layer is configured to include a truncated length such that lateral ends of the etch stop layer terminate substantially above opposite edges of the photosensitive material formation.

36. A photonics structure, comprising:

a photonics dielectric stack on a substrate, the photonics dielectric stack including a dielectric layer and one or more photonics devices having a photosensitive material formation;

a first dielectric material layer with a first portion thereof formed over the photosensitive material formation, and a second portion thereof formed over the dielectric layer of the dielectric stack;

an etch stop layer over the first dielectric material layer; and

a second dielectric material layer over the etch stop layer, the second dielectric material layer including an etched trench over the photosensitive material formation, the etched trench extending through the etch stop layer and the first dielectric material layer, wherein a bottom of the trench is delimited by the photosensitive material formation, wherein the etch stop layer is configured such that left and right ends of the etch stop layer are substantially aligned above, respectively, left and right sections of the photosensitive material formation to reduce optical coupling.