

What is Claimed is:

1. A layered structure comprising:
a starting material layer; and
a fully depleted porous layer over the
starting material layer, wherein a first band gap of
5 the fully depleted porous layer is greater than a
second band gap of the starting material and the fully
depleted porous layer is elementally identical to the
starting material.
2. The layered structure of claim 1,
wherein the fully depleted porous layer is between 10-
20 μ m thick with resistivity greater than 10000 ohm-cm.
3. The layered structure of claim 1,
wherein the starting material comprises silicon.
4. The layered structure of claim 1,
wherein the starting material comprises a material
having resistivity in a range of 0.1 to 10 ohm-cm.
5. The layered structure of claim 1, the
starting material comprises a plurality of layers
stacked vertically, wherein a resistivity of the
plurality of layers of the starting material varies.
6. The layered structure of claim 1,
wherein the starting material layer is a silicon
substrate with a <111> or <100> crystal orientation.

7. The layered structure of claim 1, wherein the fully depleted porous layer comprises a first porosity in a first region and a second porosity in a second region.

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8. The layered structure of claim 1, wherein the fully depleted porous layer is lattice matched to the starting material.

9. The layered structure of claim 7, wherein the fully depleted porous layer comprises a plurality of sublayers stacked vertically, wherein a porosity of the plurality of sublayers is graded with a sublayer with a low porosity at a surface of the fully depleted porous layer, and a sublayer with a high porosity at an interface of the fully depleted porous layer and the starting material.

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10. The layered structure of claim 7, wherein the fully depleted porous layer comprises a plurality of sublayers stacked vertically, wherein a porosity of the plurality of sublayers is graded with a sublayer with a high porosity at a surface of the fully depleted porous layer, and a sublayer with a low porosity at an interface of the fully depleted porous layer and the starting material.

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11. The layered structure of claim 7, wherein the fully depleted porous layer comprises periodically alternating sublayers of the first porosity and the second porosity.

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12. The layered structure of claim 11, wherein the first porosity is a high porosity, and the second porosity is a low porosity.

13. The layered structure of claim 11, wherein the periodically alternating sublayers of the first porosity and the second porosity form an acoustic reflector.

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14. The layered structure of claim 11, wherein the periodically alternating layers of the first porosity and the second porosity form a coherent phonon structure.

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15. The layered structure of claim 1, wherein a thermal conductivity is at least equal to 3 W/mK.

16. The layered structure of claim 1, wherein the permittivity is in a range of approximately 2 to 4 farads per meter.

17. A layered structure comprising:
a starting material layer;
a fully depleted porous layer over the starting material, wherein a first band gap of the
5 fully depleted porous layer is greater than a second band gap of the starting material and the fully depleted porous layer is elementally identical to the starting material; and

an epitaxial layer grown over the fully
10 depleted porous layer.

18. The layered structure of claim 17,
wherein the epitaxial layer is a silicon semiconductor
layer.

19. The layered structure of claim 17,
wherein the epitaxial layer is selected from the group
consisting of a InP layer, a cREO layer, a Mo layer, a
AlGaInN layer, a RE-III-N layer and a metal layer.

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20. The layered structure of claim 17,
wherein the layered structure is a layer of an RF
switch structure.

21. The layered structure of claim 17,
wherein the layered structure is a layer of an
integrated passive device.

22. The layered structure of claim 17,
wherein the layered structure is a layer in an RF
filter.

23. The layered structure of claim 17,
wherein the starting material comprises a first region
having a first resistivity and a second region having a
second resistivity.

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24. The layered structure of claim 23,
wherein:

the fully depleted porous layer is formed over the first region; and

5 the layered structure further comprises a non-fully depleted porous layer formed over the second region.

25. The layered structure of claim 17, wherein the starting material layer is a silicon substrate with a <111> or <100> crystal orientation.

26. A method of forming a layered structure, the method comprising:

forming a fully depleted porous layer from a starting material, wherein a first band gap of the
5 fully depleted porous layer is greater than a second band gap of the starting material and the fully depleted porous layer is elementally identical to the starting material.

27. The method of claim 26, wherein the starting material is a p-type, boron doped substrate having a resistivity in the range of 0.1 to 10 ohm-cm.

28. The method of claim 26, further comprising:

growing an epitaxial layer over the fully depleted porous layer.

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29. The method of claim 26, wherein the starting material is a silicon substrate with a <111> or <100> crystal orientation.