

CLAIMS

1. A method of manufacturing a substrate, the method comprising:
forming a support structure by:
 providing a polycrystalline ceramic core;
 encapsulating the polycrystalline ceramic core in a first adhesion shell;
 encapsulating the first adhesion shell in a conductive shell;
 encapsulating the conductive shell in a second adhesion shell; and
 encapsulating the second adhesion shell in a barrier shell;
 joining a bonding layer to the support structure;
 joining a substantially single crystalline silicon layer to the bonding layer;
 forming an epitaxial silicon layer by epitaxial growth on the substantially single crystalline silicon layer; and
 forming one or more epitaxial III-V layers by epitaxial growth on the epitaxial silicon layer.
2. The method of claim 1 further comprising forming a plurality of vias passing from the one or more epitaxial III-V layers to the epitaxial silicon layer.
3. The method of claim 1 wherein the polycrystalline ceramic core comprises aluminum nitride.
4. The method of claim 1 wherein the one or more epitaxial III-V layers comprise an epitaxial gallium nitride layer.
5. The method of claim 1 wherein:
 the first adhesion shell comprises a first tetraethyl orthosilicate (TEOS) shell;
 the conductive shell comprises a polysilicon shell;
 the second adhesion shell comprises a second TEOS shell;
 the barrier shell comprises a silicon nitride shell; and
 the bonding layer comprises silicon oxide.
6. The method of claim 5 wherein:

the first TEOS shell comprises a single layer of TEOS;
the polysilicon shell comprises a single layer of polysilicon;
the second TEOS shell comprises a single layer of TEOS; and
the silicon nitride shell comprises a single layer of silicon nitride.

7. The method of claim 1 wherein a thickness of the one or more epitaxial III-V layers is 5 μm or greater.

8. The method of claim 1 wherein joining the substantially single crystalline silicon layer is performed by a wafer bonding process.

9. The method of claim 8 wherein the substantially single crystalline silicon layer has a thickness of 0.5 μm .

10. A method of manufacturing a substrate, the method comprising:
forming a support structure by:
 providing a polycrystalline ceramic core;
 forming a first adhesion layer coupled to the polycrystalline ceramic core;
 forming a conductive layer coupled to the first adhesion layer;
 forming a second adhesion layer coupled to the conductive layer; and
 forming a barrier layer coupled to the second adhesion layer, wherein the barrier layer encapsulates the polycrystalline ceramic core, the first adhesion layer, the conductive layer, and the second adhesion layer;
 forming a bonding layer coupled to the support structure;
 joining a substantially single crystalline silicon layer to the bonding layer;
and
 forming one or more epitaxial III-V layers coupled to the substantially single crystalline silicon layer.

11. The method of claim 10 wherein the polycrystalline ceramic core comprises aluminum nitride.

12. The method of claim 11 wherein the one or more epitaxial III-V layers comprise an epitaxial gallium nitride layer.

13. The method of claim 12 wherein the epitaxial gallium nitride layer has a thickness of 5 μm or greater.

14. The method of claim 10 wherein joining the substantially single crystalline silicon layer is performed by a wafer bonding process.

15. The method of claim 14 further comprising, before forming the one or more epitaxial III-V layers:

forming an epitaxial silicon layer coupled to the substantially single crystalline silicon layer;

wherein the one or more epitaxial III-V layers are coupled to the epitaxial silicon layer.

16. The method of claim 15 wherein the epitaxial silicon layer is strained.

17. The method of claim 10 wherein:

the first adhesion layer comprises tetraethyl orthosilicate (TEOS);

the conductive layer comprises polysilicon;

the second adhesion layer comprises TEOS;

the barrier layer comprises silicon nitride; and

the bonding layer comprises silicon oxide.

18. The method of claim 17 wherein:

the first adhesion layer encapsulates the polycrystalline ceramic core;

the conductive layer encapsulates the first adhesion layer; and

the second adhesion layer encapsulates the conductive layer.