## Claims

1. An epitaxial semiconductor structure comprising:

an engineered substrate having a substrate coefficient of thermal expansion, the engineered substrate comprising:

a polycrystalline ceramic core;

a dielectric barrier layer encapsulating the polycrystalline ceramic core;

a bonding layer coupled to the dielectric barrier layer; and

an exfoliated single crystalline layer coupled to the bonding layer; and

an epitaxial layer coupled to the exfoliated single crystalline layer, wherein the epitaxial layer is characterized by an epitaxial coefficient of thermal expansion substantially equal to the substrate coefficient of thermal expansion.

2. The epitaxial semiconductor structure of claim 1 wherein the exfoliated single crystalline layer comprises a silicon carbide (SiC) layer.

3. The epitaxial semiconductor structure of claim 1 wherein the exfoliated single crystalline layer comprises a gallium nitride (GaN) layer.

4. The epitaxial semiconductor structure of claim 1 wherein the exfoliated single crystalline layer comprises a silicon germanium (SiGe) layer.

5. The epitaxial semiconductor structure of claim 1 wherein the exfoliated single crystalline layer and the epitaxial layer are substantially lattice-matched.

6. The epitaxial semiconductor structure of claim 1 further comprising a buffer layer disposed between the exfoliated single crystalline layer and the epitaxial layer.

7. The epitaxial semiconductor structure of claim 6 further comprising a silicon nitride layer disposed between the buffer layer and the epitaxial layer.

8. The epitaxial semiconductor structure of claim 1 wherein the epitaxial layer comprises gallium nitride (GaN).

9. The epitaxial semiconductor structure of claim 8 wherein the epitaxial layer

comprises one or more doped GaN layers.

10. The epitaxial semiconductor structure of claim 9 wherein the one or more doped GaN layers comprise an n-type GaN layer.

11. The epitaxial semiconductor structure of claim 9 wherein the one or more doped GaN layers comprise a p-type GaN layer.

12. The epitaxial semiconductor structure of claim 8 wherein the epitaxial layer comprises one or more layers of undoped GaN and n-type GaN.

13. The epitaxial semiconductor structure of claim 8 wherein the epitaxial layer comprises one or more layers of undoped GaN and p-type GaN.

14. The epitaxial semiconductor structure of claim 8 wherein the epitaxial layer comprises one or more layers of undoped GaN, n-type GaN, and p-type GaN.

15. The epitaxial semiconductor structure of claim 8 wherein the epitaxial layer comprises unintentionally doped GaN.

16. The epitaxial semiconductor structure of claim 1 wherein the epitaxial layer comprises alternating layers of undoped GaN and doped GaN.

17. The epitaxial semiconductor structure of claim 16 wherein the doped GaN comprises carbon-doped GaN (C-GaN) or iron-doped GaN (Fe-GaN).

18. The epitaxial semiconductor structure of claim 1 wherein the epitaxial layer comprises:

a doped gallium nitride (GaN) layer; and

an undoped GaN layer;

the epitaxial semiconductor structure further comprising:

a buffer layer disposed between the exfoliated single crystalline layer and the epitaxial layer;

an aluminum gallium nitride (AlGaN) layer coupled to the epitaxial layer; and

a cap layer.

19. The epitaxial semiconductor structure of claim 1 wherein the epitaxial layer comprises an aluminum gallium nitride (AlGaN) layer.

20. The epitaxial semiconductor structure of claim 19 wherein the AlGaN layer has an aluminum mole fraction less than 10%.