

WHAT IS CLAIMED IS:

- 1 1. A method of fabricating a substantially planar ceramic substrate
2 structure, the method comprising:
3 providing a ceramic substrate having a front surface;
4 encapsulating the ceramic substrate in a barrier layer;
5 forming a bonding layer coupled to the barrier layer;
6 removing a portion of the bonding layer to expose at least a portion of the
7 barrier layer and to define fill regions; and
8 depositing a second bonding layer on the at least a portion of the exposed
9 barrier layer and the fill regions.
- 1 2. The method of claim 1 wherein the ceramic substrate is characterized
2 by a plurality of voids and the bonding layer fill regions disposed between the plurality of
3 voids.
- 1 3. The method of claim 1 wherein removing the portion of the bonding
2 layer comprises a chemical-mechanical polishing (CMP) process.
- 1 4. The method of claim 3 wherein the CMP process terminates at the
2 barrier layer.
- 1 5. The method of claim 4 wherein the barrier layer comprises silicon
2 nitride.
- 1 6. The method of claim 1 wherein the front surface of the ceramic
2 substrate is characterized by an RMS roughness in the range of 50-600 nm and the second
3 bonding layer is characterized by an RMS roughness in the range of 0.5-5 nm.
- 1 7. The method of claim 1 wherein the bonding layer comprises silicon
2 oxide and the second bonding layer comprises a silicon oxide layer between 100 nm and
3 1,000 nm in thickness.
- 1 8. The method of claim 1 wherein the second bonding layer comprises a
2 different material than the bonding layer.
- 1 9. The method of claim 8 wherein the bonding layer comprises silicon
2 oxide and the second bonding layer comprises DLC.

1 10. The method of claim 1 further comprising, after removing a portion of
2 the bonding layer, forming a second barrier shell encapsulating the exposed barrier layer and
3 the fill regions.

1 11. The method of claim 1 wherein forming the bonding layer comprises
2 repeating a cycle of deposition/polishing one or more times.

1 12. The method of claim 11 wherein the repeated cycle of
2 deposition/polishing comprises deposition of different materials.

1 13. The method of claim 1 further comprising:
2 joining a substantially single crystal layer to the second bonding layer,
3 wherein the substantially single crystal layer is characterized by a first surface roughness;
4 processing the substantially single crystal layer to form a growth surface
5 characterized by a second surface roughness less than the first surface roughness; and
6 forming an epitaxial layer coupled to the growth surface.

1 14. A method of fabricating a substantially planar ceramic substrate
2 structure, the method comprising:
3 providing a ceramic substrate having a front surface;
4 forming a bonding layer coupled to the front surface of the ceramic substrate;
5 performing a chemical-mechanical polishing (CMP) process to remove a
6 portion of the bonding layer and to expose at least a portion of the front surface of the
7 ceramic substrate; and
8 encapsulating the ceramic substrate in a barrier layer.

1 15. The method of claim 14 further comprising depositing an adhesion
2 promotion layer between the front surface of the ceramic substrate and the bonding layer.

1 16. The method of claim 14 wherein, after performing the CMP process,
2 fill regions are disposed between adjacent peaks in the ceramic substrate.

1 17. The method of claim 14 further comprising depositing an electrically
2 conductive layer coupled to at least a portion of the barrier layer.

1 18. The method of claim 14 further comprising depositing a thermally
2 conductive layer coupled to at least a portion of the barrier layer.

1 19. The method of claim 14 further comprising depositing a second
2 bonding layer coupled to at least a portion of the barrier layer.

1 20. The method of claim 14 further comprising:
2 depositing an electrically conductive layer coupled to at least a portion of the
3 barrier layer;
4 depositing a thermally conductive layer coupled to at least a portion of the
5 electrically conductive layer; and
6 depositing a second bonding layer coupled to at least a portion of the
7 thermally conductive layer.