CLAIMS

We claim:

1. A semiconductor device, comprising:

a first substrate;

a second substrate having a plurality of projections and a plurality of intermediate regions, with individual intermediate regions bounded by neighboring projections and having a blind end, at least one of the first and second substrates having a plurality of solid-state transducers, wherein individual solid-state transducers are disposed at least partially within corresponding intermediate regions; and

a discontinuous bond between the first substrate and the second substrate, the discontinuous bond comprising a bonding material bonded to the second substrate at the blind end of the intermediate regions, with the solid-state transducers disposed between the first substrate and the bonding material.

2. The semiconductor device of claim 1 wherein the plurality of intermediate regions and the projections form a first pattern at the second substrate, and wherein the plurality of solid-state transducers and the bonding material form a second pattern, the second pattern being the inverse of the first pattern.

3. The semiconductor device of claim 2 wherein the bonding material comprises a bonding metal, and wherein the first pattern comprises a waffle pattern and the second pattern comprises an inverted waffle pattern.

4. The semiconductor device of claim 1 wherein the plurality of solid-state transducers comprise light-emitting diodes.

5. A bonded assembly, comprising:

a first substrate carrying a transducer structure and a bonding material with the transducer structure disposed between the first substrate and the bonding material; and

a second substrate, the second substrate having a series of projections forming a pattern, wherein the first substrate is bonded to the second substrate with a discontinuous bond in regions between the projections.

6. The bonded assembly of claim 5 wherein the discontinuous bond comprises a series of sections of the bonding material bonded to the second substrate, separated by sections of the bonding material not bonded to the second substrate.

7. The bonded assembly of claim 5 wherein the bonding material comprises a bonding metal, and wherein the transducer structure comprises a light-emitting diode.

8. A semiconductor device, comprising:

a first substrate carrying a bonding material and a plurality of solid-state transducers disposed between the first substrate and the bonding material; and

a second substrate bonded to the first substrate with a discontinuous bond, the discontinuous bond comprising a plurality of spaced-apart bond segments, with individual bond segments including a portion of the bonding material bonded to both the solid-state transducers and to the second substrate.

9. The semiconductor device of claim 8 wherein the second substrate includes projections that at least partially define a plurality of regions in the second substrate, wherein individual regions are partially occupied by the bonding material and partially occupied by one of the plurality of solid-state transducers, wherein the projections form a grid pattern of streets between neighboring solid-state transducers.

10. The semiconductor device of claim 8 wherein the individual bond segments are separated by sections of void space defined at least partially by a gap between neighboring solid-state transducers.

11. A semiconductor device, comprising:

a carrier substrate, wherein the carrier substrate includes a plurality of projections separated by intermediate regions; and

a plurality of solid-state transducers, with individual solid-state transducers disposed at least partially within corresponding intermediate regions, wherein the individual solid-state transducers are bonded to the carrier substrate with bonding material.

12. The semiconductor device of claim 11 wherein the projections and the intermediate regions form a rectilinear pattern in the carrier substrate.

13. The semiconductor device of claim 11 wherein the plurality of solid-state transducers comprise light-emitting diodes.

14. A method for fabricating a semiconductor device, the method comprising:

forming a plurality of solid-state transducers in a device substrate;

forming a plurality of recesses in a carrier substrate; and

bonding the carrier substrate to the device substrate with a discontinuous bond, wherein the discontinuous bond comprises bonding material between individual solid-state transducers and a blind end of corresponding individual recesses.

15. The method of claim 14 wherein the plurality of recesses form a first pattern and the plurality of solid-state transducers form a second pattern that is the inverse of the first pattern, and wherein bonding the carrier substrate to the device substrate includes aligning the first pattern with the second pattern and bringing the device substrate and the carrier substrate together.

16. The method of claim 15 wherein aligning the first pattern with the second pattern includes optically aligning the first pattern with the second pattern.

17. The method of claim 14, further comprising at least restricting the bonding material from flowing across the carrier substrate by confining the bonding material to the plurality of recesses.

18. The method of claim 14 wherein the individual recesses are separated by projections of the carrier substrate, and wherein the projections form streets, the method further comprising:

removing the device substrate without removing the plurality of solid-state transducers; and

dicing the carrier substrate along the streets to form a plurality of individual semiconductor devices.

19. A method for fabricating a semiconductor assembly, the method comprising:

aligning a carrier substrate having a plurality of recesses with a device substrate having a plurality of solid-state transducers;

containing a bonding material in the plurality of recesses; and

bonding the device substrate to the carrier substrate with a discontinuous bond while containing the bonding material in the plurality of recesses.

20. The method of claim 19 wherein bonding the device substrate to the carrier substrate includes optically aligning the plurality of solid-state transducers with the plurality of recesses.

21. The method of claim 19 wherein bonding the device substrate to the carrier substrate with a discontinuous bond includes:

forming individual segments of the discontinuous bond by bonding individual solid-state transducers to a blind end of a corresponding recess with the bonding material;

inserting projections of the carrier substrate into trenches, wherein the trenches surround the individual solid-state transducers, and wherein the projections at least partially define discontinuities in the discontinuous bond; and

elevating a temperature of the carrier substrate and the device substrate while containing the bonding material in the plurality of recesses.

CLAIMS

1. A semiconductor device, comprising:

a first substrate;

a second substrate having a plurality of projections and a plurality of recesses, with individual recesses bounded by neighboring projections and having a closed end, at least one of the first and second substrates having a plurality of solid-state transducers, wherein individual solid-state transducers are disposed at least partially within corresponding recesses, and wherein the projections are directly adjacent to the first substrate; and

a discontinuous bond between the first substrate and the second substrate, the discontinuous bond comprising a bonding material bonded to the second substrate at the closed end of the recesses, with the solid-state transducers disposed between the first substrate and the bonding material.

2. The semiconductor device of claim 1 wherein the plurality of recesses and the projections form a first pattern at the second substrate, and wherein the plurality of solid-state transducers and the bonding material form a second pattern, the second pattern being the inverse of the first pattern.

3. The semiconductor device of claim 2 wherein the bonding material comprises a bonding metal, and wherein the first pattern comprises a waffle pattern and the second pattern comprises an inverted waffle pattern.

4. The semiconductor device of claim 1 wherein the plurality of solid-state transducers comprise light-emitting diodes.

5. A bonded assembly, comprising:

a first substrate carrying a transducer structure and a bonding material with the transducer structure disposed between the first substrate and the bonding material; and

a second substrate, the second substrate having a series of projections forming a pattern, wherein the first substrate is bonded to the second substrate with a discontinuous

bond in regions between the projections, and wherein the projections are directly adjacent to the first substrate.

6. The bonded assembly of claim 5 wherein the discontinuous bond comprises a series of sections of the bonding material bonded to the second substrate, separated by sections of the bonding material not bonded to the second substrate.

7. The bonded assembly of claim 5 wherein the bonding material comprises a bonding metal, and wherein the transducer structure comprises a light-emitting diode.

8. A semiconductor device, comprising:

a first substrate carrying a bonding material and a plurality of solid-state transducers disposed between the first substrate and the bonding material; and

a second substrate bonded to the first substrate with a discontinuous bond, the discontinuous bond comprising a plurality of spaced-apart bond segments, with individual bond segments including a portion of the bonding material bonded to both the solid-state transducers and to the second substrate, and wherein at least a portion of the first substrate is positioned directly adjacent to a portion of the second substrate.

9. A semiconductor device, comprising:

a first substrate carrying a bonding material and a plurality of solid-state transducers disposed between the first substrate and the bonding material; and

a second substrate bonded to the first substrate with a discontinuous bond, the discontinuous bond comprising a plurality of spaced-apart bond segments, with individual bond segments including a portion of the bonding material bonded to both the solid-state transducers and to the second substrate, wherein the second substrate includes projections that at least partially define a plurality of regions in the second substrate, wherein individual regions are partially occupied by the bonding material and partially occupied by one of the plurality of solid-state transducers, and wherein the projections form a grid pattern of streets between neighboring solid-state transducers.

10. The semiconductor device of claim 8 wherein the individual bond segments are separated by sections of void space defined at least partially by a gap between neighboring solid-state transducers.