Claims

What is claimed:

1. A method of making a semiconductor device, comprising:

forming a polymer matrix composite substrate;

forming a first insulating layer ~~over~~directly on a first surface of the polymer matrix composite substrate;

forming a first conductive layer ~~over~~directly on the first insulating layer;

forming a second insulating layer over the first insulating layer and first conductive layer;

forming a second conductive layer over the second insulating layer and extending to the first conductive layer;

forming a third insulating layer over the second insulating layer and second conductive layer;

removing a portion of the third insulating layer to expose the second conductive layer; and

forming a bump over the second conductive layer.

2. The method of claim 1, wherein forming the polymer matrix composite substrate includes:

providing a chase mold having first and second plates;

applying a first releasable layer over the first plate;

forming a metal carrier over the second plate;

applying a second releasable layer over the metal carrier; and

depositing an encapsulant material between the first and second plates of the chase mold.

3. The method of claim 1, further including forming a third conductive layer between the first conductive layer and second conductive layer.

4. The method of claim 1, further including forming a fourth insulating layer over a second surface of the polymer matrix composite substrate, opposite the first surface of the polymer matrix composite substrate.

5. The method of claim 1, further including forming a fourth insulating layer over the first insulating layer prior to forming the first conductive layer.

6. The method of claim 1, wherein the second conductive layer is wound to exhibit inductive properties.

7. A method of making a semiconductor device, comprising:

forming a molded substrate by,

(a) providing a chase mold including first and second plates, and

(b) depositing an encapsulant material between the first and second plates;

forming a first conductive layer over the molded substrate;

forming a first insulating layer over the molded substrate and first conductive layer;

forming an integrated passive device including a second conductive layer over the first insulating layer and extending to the first conductive layer;

forming a second insulating layer over the first insulating layer and second conductive layer; and

forming an interconnect structure over the second conductive layer.

8. The method of claim 7, wherein forming the molded substrate includes:

providing a chase mold having first and second plates;

applying a first releasable layer over the first plate; and

applying a second releasable layer over the ~~over the~~ second plate~~; and~~

~~depositing an encapsulant material between the first and second plates of the chase mold~~.

9. The method of claim 7, further including forming a third conductive layer between the first conductive layer and second conductive layer.

10. The method of claim 7, further including:

forming a third insulating layer over a first surface of the molded substrate prior to forming the first conductive layer; and

forming a fourth insulating layer over a second surface of the molded substrate, opposite the first surface of the molded substrate.

11. The method of claim 7, further including:

forming a third insulating layer over a first surface of the molded substrate prior to forming the first conductive layer; and

forming a fourth insulating layer over the third insulating layer.

12. The method of claim 7, wherein the second conductive layer is wound to exhibit inductive properties.

13. The method of claim 7, wherein the interconnect structure includes a bump or bond wire.

~~14. A method of making a semiconductor device, comprising:~~

~~forming a polymer matrix composite substrate;~~

~~forming an inductor over the polymer matrix composite substrate; and~~

~~forming an interconnect structure over the inductor.~~

1~~5~~4. ~~The method of claim 14, wherein~~ A method of making a semiconductor device, comprising:

forming ~~the~~a polymer matrix composite substrate ~~includes~~ by:

(a)providing a chase mold having first and second plates~~;~~,

(b)applying a first releasable layer over the first plate~~;~~,

(c)applying a second releasable layer over the second plate~~;~~, and

(d)depositing an encapsulant material between the first and second plates of the chase mold~~.~~;

forming an inductor over the polymer matrix composite substrate; and

forming an interconnect structure over the inductor.

1~~6~~5. The method of claim 14, further including:

forming a first conductive layer over the polymer matrix composite substrate;

forming a first insulating layer over the polymer matrix composite substrate and first conductive layer;

forming a second conductive layer over the first insulating layer and first conductive layer;

forming a second insulating layer over the first insulating layer and second conductive layer; and

forming the interconnect structure over the second conductive layer.

176. The method of claim 165, further including forming a third conductive layer between the first conductive layer and second conductive layer.

187. The method of claim 165, further including:

forming a third insulating layer over a first surface of the polymer matrix composite substrate prior to forming the first conductive layer; and

forming a fourth insulating layer over a second surface of the polymer matrix composite substrate, opposite the first surface of the polymer matrix composite substrate.

198. The method of claim 165, further including:

forming a third insulating layer over a first surface of the polymer matrix composite substrate prior to forming the first conductive layer; and

forming a fourth insulating layer over the third insulating layer.

~~20. A semiconductor device, comprising:~~

~~a polymer matrix composite substrate;~~

~~a first conductive layer formed over the polymer matrix composite substrate;~~

~~a first insulating layer formed over the polymer matrix composite substrate and first conductive layer;~~

~~a second conductive layer formed over the first insulating layer and first conductive layer;~~

~~a second insulating layer formed over the first insulating layer and second conductive layer; and~~

~~an interconnect structure formed over the second conductive layer.~~

~~21. The semiconductor device of claim 20, further including a third conductive layer formed between the first conductive layer and second conductive layer.~~

~~22. The semiconductor device of claim 20, further including:~~

~~a third insulating layer formed over a first surface of the polymer matrix composite substrate; and~~

~~a fourth insulating layer formed over a second surface of the polymer matrix composite substrate, opposite the first surface of the polymer matrix composite substrate.~~

~~23. The semiconductor device of claim 20, further including:~~

~~a third insulating layer formed over a first surface of the polymer matrix composite substrate; and~~

~~a fourth insulating layer formed over the third insulating layer.~~

~~24. The semiconductor device of claim 20, wherein the second conductive layer is wound to exhibit inductive properties.~~

~~25. The semiconductor device of claim 20, wherein the interconnect structure includes a bump or bond wire.~~

19. A method of making a semiconductor device, comprising:

forming a polymer matrix composite substrate in a chase mold;

forming an inductor over the polymer matrix composite substrate; and

forming an interconnect structure over the inductor.

20. The method of claim 19, further including:

forming a first conductive layer over the polymer matrix composite substrate;

forming a first insulating layer over the polymer matrix composite substrate and first conductive layer;

forming the inductor over the first insulating layer and first conductive layer;

forming a second insulating layer over the first insulating layer and inductor; and

forming the interconnect structure over the inductor.

21. The method of claim 20, further including forming a third conductive layer between the first conductive layer and inductor.

22. The method of claim 20, further including:

forming a third insulating layer over a first surface of the polymer matrix composite substrate prior to forming the first conductive layer; and

forming a fourth insulating layer over a second surface of the polymer matrix composite substrate, opposite the first surface of the polymer matrix composite substrate.

23. The method of claim 20, further including:

forming a third insulating layer over a first surface of the polymer matrix composite substrate prior to forming the first conductive layer; and

forming a fourth insulating layer over the third insulating layer.

24. The method of claim 19, wherein forming the polymer matrix composite substrate includes:

providing the chase mold having first and second plates;

applying a first releasable layer over the first plate;

forming a metal carrier over the second plate;

applying a second releasable layer over the metal carrier; and

depositing an encapsulant material between the first and second plates.