

CLAIMS

What is claimed is:

1. A semiconducting device comprising:
5 a front end of line (FEOL) portion; and
a back end of line (BEOL) portion electrically coupled to the FEOL portion, the BEOL portion including at least one BEOL level having:
a dielectric layer, the dielectric layer including at least one section formed from a low-k material including deuterium (D);
10 an etch stop layer disposed over the dielectric layer, and
at least one conductive structure disposed within the dielectric layer, the at least one conductive structure extending through the dielectric layer and the etch stop layer, respectively.
- 15 2. The semiconducting device of claim 1, wherein the low-k material is a carbon doped oxide dielectric material including silicon (Si), carbon (C), oxygen (O), and deuterium (D).
3. The semiconducting device of claim 1, wherein the low-k material is a carbon doped oxide dielectric material including silicon (Si), carbon (C), oxygen (O), hydrogen (H), and
20 deuterium (D).
4. The semiconducting device of claim 3, wherein the hydrogen (H) to deuterium (D) ratio is between approximately 1% hydrogen (H) to 99% deuterium (D) to approximately 90% hydrogen (H) to 10% deuterium.
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5. The semiconducting device of claim 4, wherein the hydrogen (H) to deuterium (D) ratio is approximately 50% hydrogen (H) to 50% deuterium (D).
- 30 6. The semiconducting device of claim 1, wherein the dielectric layer of the at least one BEOL level further comprises:
a first section formed from the low-k material including the deuterium (D); and
a second section formed from a distinct low-k material.

7. The semiconducting device of claim 6, wherein the distinct low-k material of the second section includes deuterium (D), the concentration of the deuterium (D) in the distinct low-k material differing from the concentration of the deuterium (D) in the low-k material forming the first section.

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8. The semiconducting device of claim 6, wherein the at least one conductive structure in the at least one BEOL level includes:

a first conductive structure disposed within and extend through the dielectric layer, and

10 a second conductive structure disposed within and extend through the dielectric layer, the second conductive structure positioned adjacent to and spaced from the first conductive structure.

9. The semiconducting device of claim 8, wherein the first section of the dielectric layer formed from the low-k material including deuterium (D) is disposed between the first
15 conductive structure and the second conductive structure.

10. The semiconducting device of claim 8, wherein the second section of the dielectric layer formed from the distinct low-k material is disposed between the first conductive structure and the second conductive structure, and
20 wherein the first section of the dielectric layer formed from the low-k material including deuterium (D) is disposed adjacent the first conductive structure and opposite the second section of the dielectric layer.

11. The semiconducting device of claim 10, wherein the dielectric layer of the at least one
25 BEOL level further comprises:
a third section formed from the low-k material including the deuterium (D), the third section of the dielectric layer disposed adjacent the second conductive structure and opposite the second section of the dielectric layer.

30 12. The semiconducting device of claim 1, wherein the at least one BEOL level includes:
a first BEOL level formed directly adjacent the FEOL portion, the first BEOL level having a first dielectric layer; and

a second BEOL level formed directly over the first BEOL level, the second BEOL level having a second dielectric layer.

13. The semiconducting device of claim 12, wherein at least one of the first dielectric layer
5 of the first BEOL level or the second dielectric layer of the second BEOL level is formed from the low-k material including deuterium (D).

14. The semiconducting device of claim 12, wherein the at least one BEOL level further
10 includes a third BEOL level formed directly over the second BEOL level, the third BEOL level having a second dielectric layer, and
wherein at least one of the first dielectric layer of the first BEOL level, the second dielectric layer of the second BEOL level, or the third dielectric layer of the third BEOL level is formed from the low-k material including deuterium (D).

15. A back end of line (BEOL) portion of a semiconducting device electrically coupled to a
15 front end of line (FEOL) portion of the semiconducting device, the BEOL portion comprising:
a first BEOL level including:
a first dielectric layer,
a first etch stop layer disposed over the first dielectric layer, and
20 a plurality of first conductive structures disposed within the first dielectric layer,
the plurality of first conductive structures extending through the first dielectric layer and
the first etch stop layer, respectively; and
a second BEOL level formed directly over the first BEOL level, the second BEOL level
including:
25 a second dielectric layer,
a second etch stop layer disposed over the second dielectric layer, and
a plurality of second conductive structures disposed within the second dielectric
layer, the plurality of second conductive structures extending through the second
dielectric layer and the second etch stop layer, respectively,
30 wherein at least one of the first dielectric layer of the first BEOL level or the second
dielectric layer of the second BEOL level is formed from a low-k material including deuterium
(D).

16. The BEOL portion of claim 15, wherein the low-k material is a carbon doped oxide dielectric material including silicon (Si), carbon (C), oxygen (O), and deuterium (D).

5 17. The BEOL portion of claim 15, wherein the low-k material is a carbon doped oxide dielectric material including silicon (Si), carbon (C), oxygen (O), hydrogen (H), and deuterium (D).

18. The BEOL portion of claim 15, further comprising:

a third BEOL level formed directly over the second BEOL level, the third BEOL level including:

10 a third dielectric layer,
a third etch stop layer disposed over the third dielectric layer, and
a plurality of third conductive structures disposed within the third dielectric layer,
the plurality of third conductive structures extending through the third dielectric layer
and the third etch stop layer, respectively,
15 wherein at least one of the first dielectric layer of the first BEOL level, the second
dielectric layer of the second BEOL level, or the third dielectric layer of the third BEOL level is
formed from the low-k material including deuterium (D).

19. A dielectric material comprising:

20 a carbon doped oxide material including silicon (Si), carbon (C), oxygen (O), and
deuterium (D).

20. The dielectric material of claim 19, further comprising:

hydrogen (H), wherein the hydrogen (H) to deuterium (D) ratio is between
25 approximately 1% hydrogen (H) to 99% deuterium (D) to approximately 90% hydrogen (H) to
10% deuterium.