

CLAIMS

1. Diamond device or structure (1) comprising:

- at least one supporting layer or material (3) including at least one or a plurality of support structures (5) inside the at least one supporting layer or material (3);
- a plurality of recesses (7) defined by the at least one or the plurality of support structures (5); and
- at least one diamond micro-seed (MS) and a plurality of diamond nano-seeds (NS) located in each recess (7) or in the plurality of recesses (7).

2. Diamond device or structure (1) according to any one of the previous claims, wherein the at least one or the plurality of support structures (5) defines an opening (OP) and an upper enclosure (UE) of each recess (7) or of the plurality of recesses (7), and the at least one diamond micro-seed (MS) is located inside the opening (OP) and/or the upper enclosure (UE).

3. Diamond device or structure (1) according to any one of the previous claims, wherein the at least one diamond micro-seed (MS) has a size or diameter (DD) that is between 40% and 95% of a size or diameter of the opening (OP).

4. Diamond device or structure (1) according to any one of the previous claims, wherein the at least one diamond micro-seed (MS) defines a nucleation or coalescence site for diamond crystal growth.

5. Diamond device or structure (1) according to any one of the previous claims 2 to 4, wherein the opening (OP) and the upper enclosure (UE) include a plurality of distributed diamond nano-seeds (NS),

wherein the diamond nano-seeds (NS) define nucleation sites for conformal diamond growth.

6. Diamond device or structure (1) according to any one of the previous claims, wherein each recess (7) or the plurality of recesses (7) is defined by at least one wall (W) and at least one floor (FL), and a plurality of diamond nano-seeds (NS) are located on the at least one wall (W) and/or on the at least one floor (FL).

7. Diamond device or structure (1) according to any one of the previous claims, wherein each recess or the plurality of recesses (7) has a depth (DP), and the depth (DP) of the recess (7) is between 60% and 1000% of a size or diameter (DD) of the at least one diamond micro-seed (MS).

8. Diamond device or structure (1) according to any one of the previous claims 1 to 6, wherein a plurality of diamond micro-seeds (MS) is located inside each recess (7) or inside the plurality of recesses (7), and the diamond micro-seeds (MS) are stacked to fill each recess (7) or the plurality of recesses (7).

9. Diamond device or structure (1) according to the previous claim, wherein the diamond micro-seeds (MS) are stacked to extend to an upper enclosure (UE) of each recess (7) or the plurality of recesses (7).

10. Diamond device or structure (1) according to anyone of the previous claims 2 to 9, wherein the at least one or the plurality of support structures (5) includes a first wall (FW), a second wall (SW) and an upper landing (UL) extending between the first and second walls (FW, SW),

and a plurality of diamond nano-seeds (NS) are located or distributed on the upper landing (UL) and on the first and second walls (FW, SW).

11. Diamond device or structure (1) according to the previous claim, wherein the least one or the plurality of support structures (5) comprises a plurality of walls (W) and a plurality of upper landings (UL) extending between the walls (W), and a plurality of diamond nano-seeds (NS) are located or distributed on the upper landings (UL) and on the walls (W).

12. Diamond device or structure (1) according to any one of the previous claims, wherein the diamond nano-seeds (NS) are distributed on or attached to a surface of the at least one supporting layer or material (3) at a density, between 10^8 cm^{-2} and 10^{14} cm^{-2} .

13. Diamond device or structure (1) according to anyone of the previous claims, wherein the recesses (7) are located on at least one area or a plurality of areas of the at least one supporting layer or material (3), or the recesses (7) are located fully across the at least one supporting layer or material (3).

14. Diamond device or structure (1) according to any one of the previous claims, further including a diamond layer attached to the at least one supporting layer or material (3),

wherein the diamond micro-seeds (MS) are arranged inside the recesses (7) and the diamond nano-seeds (NS) are distributed on the at least one supporting layer or material (3) and inside the recesses (7) to chemically bond and/or mechanically anchor or fix the diamond layer (9) to the at least one supporting layer or material (3).

15. Diamond device or structure (1) according to the previous claims 14, wherein a lower enclosure (LE) of each recess (7) or the plurality of recesses (7) is diamond growth-free.

16. Diamond device or structure (1) according to the previous claim, wherein the diamond device or structure (1) is AlN interlayer-free, SiN interlayer-free or SiC interlayer-free between the diamond layer (9) and the at least one supporting layer or material (3).

17. Diamond device or structure (1) according to any one of the previous claims, wherein the diamond device or structure (1) includes a plurality of supporting layers or materials (3), and the at least one or the plurality of support structures (5) is located inside the plurality of supporting layers or materials (3).

18. Diamond device or structure (1) according to the previous claim, wherein the at least one or the plurality of support structures (5) is located inside the at least one layer (3) or the plurality of layers (3); or inside the at least one layer or the plurality of layers (3) and the substrate (3A).

19. Diamond device or structure (1) according to the previous claim 18, wherein the recesses (7) extend through only the at least one or the plurality of layers (3) attached to the substrate (3A), or extend through the at least one or the plurality of layers (3) attached to the substrate (3A) and into the substrate (3A).

20. Method for producing a diamond device or structure (1) comprising the steps of:

- providing at least one supporting layer or material (3) including at least one or a plurality of support structures (5) inside the at least one supporting layer or material (3) and a plurality of recesses (7) defined by the at least one or the plurality of support structures (5); and

- carrying out diamond seeding to provide at least one diamond micro-seed (MS) and a plurality of diamond nano-seeds (NS) in each recess (7) or in the plurality of recesses (7).

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