CLAIMS

1. A process for fabricating a composite structure comprising a thin layer made of single-crystal silicon carbide positioned on a carrier substrate made of polycrystalline silicon carbide, the process comprising:

a) a step of providing an initial substrate made of single-crystal silicon carbide, having a front face and a back face, and a carrier substrate made of polycrystalline silicon carbide having a front face and a back face,

b) a step of porosification applied to the initial substrate, in order to form a porous layer at least on the front face side of the initial substrate,

c) a step of forming a superficial layer made of amorphous silicon carbide, on the front face of the carrier substrate and/or on the porous layer,

d) a step of joining the initial substrate and the carrier substrate at their respective front faces, leading to the production of a first intermediate structure,

e) a heat treatment step applied to the first intermediate structure, at a temperature above 900°C, in order to crystallize the superficial layer, at least partly in the form of single-crystal silicon carbide, starting from a contact interface with the porous layer, in order to form the thin layer, step e) leading to the production of a second intermediate structure,

f) a step of separation in the porous layer of the second intermediate structure, in order to obtain the composite structure on the one hand and the remainder of the initial substrate on the other hand.

2. The fabrication process according to claim 1, in which, at the end of step b), the porous layer has a thickness of between 0.5 µm and 5 µm.

3. The fabrication process according to either of the preceding claims, in which, at the end of step b), the porous layer comprises pores, the size of which is between 1 nm and 50 nm, and has a degree of porosification of between 10% and 70%.

4. The fabrication process according to one of the preceding claims, in which, at the end of step c), the superficial layer has a thickness of less than or equal to 10 μm.

5. The fabrication process according to one of the preceding claims, in which, at the end of step c), the superficial layer has a thickness of less than or equal to 1 μm, typically of the order of a hundred to several hundreds of nanometres.

6. The fabrication process according to one of the preceding claims, in which step c) comprises the deposition of an amorphous silicon carbide layer, at least on the front face side of the carrier substrate and/or at least on the porous layer, in order to form the superficial layer(s).

7. The fabrication process according to claim 6, in which the amorphous silicon carbide layer deposited is highly doped and has a concentration of dopant species of greater than $10^{19}/cm^3$, or greater than $10^{20}/cm^3$.

8. The fabrication process according to one of Claims 1 to 5, in which step c) comprises an amorphization of a surface layer of the carrier substrate, at least on the front face side thereof, in order to form the superficial layer.

9. The fabrication process according to one of the preceding claims, in which step d) comprises, prior to the joining of the initial substrate and the carrier substrate, the formation of a bonding layer on one and/or the other of the substrates, on the side of the respective front faces thereof,
the bonding layer having, after joining, a total thickness of less than or equal to 10 nm.

10. The fabrication process according to claim 9, in which the bonding layer is composed of at least one material chosen from silicon, nickel, titanium and tungsten.

11. The fabrication process according to either of the preceding two claims, in which, during step e), a segmentation into nodules or a dissolution of the bonding layer allows direct contact, at least locally, between the superficial layer and the porous layer or between the superficial layer and the carrier substrate.

12. The fabrication process according to one of the preceding claims, in which the heat treatment of step e) is carried out at a temperature above or equal to 1000°C, preferentially above or equal to 1400°C, or above or equal to 1850°C.

13. The fabrication process according to one of the preceding claims, in which, in step e), the crystallization of the superficial layer occurs at least partly in the form of polycrystalline silicon carbide, starting from a contact interface with the carrier substrate, in order to form an intermediate layer.

14. The fabrication process according to one of the preceding claims, comprising, after step f), a finishing step g) comprising mechanical and/or chemical treatment(s) on the composite structure, in order to eliminate residues of the porous layer from the front face of the thin layer and/or to correct the thickness uniformity of the composite structure.

15. The fabrication process according to claim 14, in which step g) comprises a heat treatment, applied to the composite structure, at a temperature of between 1000°C and 1900°C, before or after the mechanical and/or chemical treatment(s).

16. The fabrication process according to one of the preceding claims, comprising a step of reconditioning the remainder of the initial substrate for reuse as initial substrate for the fabrication of a new composite structure.

17. An intermediate structure comprising:

- a carrier substrate made of polycrystalline silicon carbide,
- at least one superficial layer made of amorphous silicon carbide, positioned on the carrier substrate, on the front face side thereof,
- a porous layer positioned on the superficial layer,
- an initial substrate made of single-crystal silicon carbide on the porous layer,

the porous layer being positioned, directly in contact or via a bonding layer, on the superficial layer, a bonding interface being present between the porous layer and the superficial layer, or

the superficial layer being positioned, directly in contact or via a bonding layer, on the carrier substrate, a

bonding interface being present between the carrier substrate and the superficial layer, or

a superficial layer on the porous layer side being positioned, directly in contact or via a bonding layer, on another superficial layer on the carrier substrate side, a bonding interface being present between the two superficial layers.