

CLAIMS

1. Process for manufacturing a composite structure ~~(1)~~ comprising a thin layer ~~(10)~~ made of monocrystalline silicon carbide arranged on a carrier substrate ~~(20)~~ made of silicon carbide, the process comprising:
 - a) a step of providing a substrate ~~(111)~~ made of monocrystalline silicon carbide,
 - b) a step of ion implantation of light species into the donor substrate ~~(111)~~, to form a buried brittle plane ~~(12)~~ delimiting the thin layer ~~(10)~~ between said buried brittle plane ~~(12)~~ and a free surface of said donor substrate ~~(111)~~,
 - c) a succession of n steps of forming crystalline carrier layers ~~(20'')~~, with n greater than or equal to 2; the n crystalline carrier layers ~~(20'')~~ being positioned on the front face of the donor substrate ~~(111)~~ successively one on the other, and forming the carrier substrate ~~(20)~~; each formation step comprising:
 - direct liquid injection chemical vapour deposition, at a temperature below 900°C, to form a carrier layer ~~(20')~~, said carrier layer ~~(20')~~ being formed by an at least partially amorphous SiC matrix, and having a thickness of less than or equal to 200 microns;
 - a crystallization heat treatment of the carrier layer ~~(20')~~, at a temperature of less than or equal to 1000°C, to form a crystalline carrier layer ~~(20'')~~;
 - d) a step of separation along the buried brittle plane ~~(12)~~ to form, on the one hand, a composite structure ~~(1)~~ comprising the thin layer ~~(10)~~ on the carrier substrate ~~(20)~~ and, on the other hand, the rest ~~(111')~~ of the donor substrate.

2. Manufacturing process according to the preceding claim, comprising:
 - e) a step of mechanical and/or chemical treatment(s) of the composite structure~~-(1)~~, the treatments being applied to a free face of the carrier substrate~~-(20)~~, the rear face of the composite structure~~-(1)~~, and/or to a free face of the thin layer~~-(10)~~, the front face of the composite structure~~-(1)~~.
3. Manufacturing process according to the preceding claim, in which step e) comprises simultaneous mechanochemical polishing of the front face and of the rear face of the composite structure~~-(1)~~.
4. Manufacturing process according to one of the preceding claims, in which chemical etching, mechanical grinding and/or mechanochemical polishing is (are) applied to a free face of the carrier substrate~~-(20)~~, between step c) and step d).
5. Manufacturing process according to one of the preceding claims, in which the thickness of each deposited carrier layer ~~-(20')~~ is less than or equal to 100 microns, or even less than 50 microns, or else even less than 10 microns.
6. Manufacturing process according to one of the preceding claims, in which the depositions in step c) are performed at a temperature of between 100°C and 800°C, or even preferentially between 200°C and 600°C.
7. Manufacturing process according to one of the preceding claims, in which the depositions in step c) are performed at a pressure of between 1 Torr and 500 Torr.

8. Manufacturing process according to one of the preceding claims, in which the precursors used during the depositions in step c) are chosen from polysilylethylene and disilabutane.
9. Manufacturing process according to one of the preceding claims, in which step c) comprises a succession of n steps of forming crystalline carrier layers ~~—(20'')~~, with n between 3 and a few dozen.
10. Manufacturing process according to one of the preceding claims, in which step a) comprises:
 - a') a step of providing an initial substrate ~~—(11)~~ made of monocrystalline silicon carbide,
 - a'') a step of epitaxial growth of a monocrystalline silicon carbide donor layer ~~—(110)~~ on the initial substrate ~~—(11)~~, to form the donor substrate ~~—(111)~~, the donor layer ~~—(110)~~ having a density of crystal defects less than that of the initial substrate ~~—(11)~~.
11. Manufacturing process according to the preceding claim, in which step a') comprises the formation, on the initial substrate ~~—(11)~~, of a monocrystalline conversion layer ~~—(13)~~, to convert basal plane dislocation defects of the initial substrate ~~—(11)~~ into threading edge dislocation defects.
12. Manufacturing process according to one of the preceding claims, in which the epitaxial growth step a'') is performed at a temperature above 1200°C, preferentially between 1500°C and 1650°C.
13. Manufacturing process according to one of the preceding claims, in which the separation step d) is

performed at a temperature greater than or equal to the temperature of the crystallization heat treatments of step c).

14. Manufacturing process according to one of the preceding claims, comprising a step of reconditioning the rest ~~(111')~~ of the donor substrate for the purpose of reusing it as initial substrate or as donor substrate.