

CLAIMS

1. Process for the manufacture of 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 donor substrate ~~(111)~~ made of monocrystalline silicon carbide, the donor substrate ~~(111)~~ comprising a donor layer ~~(110)~~ produced by epitaxial growth on an initial substrate ~~(11)~~, the donor layer ~~(110)~~ exhibiting a density of crystal defects which is lower than that of the initial substrate ~~(11)~~,
 - b) a step of ion implantation of light entities into the donor layer ~~(110)~~, in order to form a buried brittle plane ~~(12)~~ delimiting the thin layer ~~(10)~~ between said buried brittle plane ~~(12)~~ and a free face of said donor layer ~~(110)~~,
 - c) a succession of n steps of formation of carrier layers ~~(20')~~, with n greater than or equal to 2; the n carrier layers ~~(20')~~ being arranged on the donor layer ~~(110)~~ successively on one another, and forming the carrier substrate ~~(20)~~; each step of formation comprising a chemical vapour deposition, at a temperature of between 400°C and 1100°C, in order to form a carrier layer ~~(20')~~ made of polycrystalline silicon carbide; the n chemical vapour depositions being carried out at n different temperatures,
 - d) a step of separation along the buried brittle plane ~~(12)~~, in order 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 remainder ~~(111')~~ of the donor substrate,
 - e) a step of mechanical and/or chemical treatment(s) of the composite structure ~~(1)~~, in order to smooth the free face

~~(10a)~~ of the thin layer ~~(10)~~ and/or in order to correct the uniformity in thickness of the composite structure ~~(1)~~.

2. Manufacturing process according to the preceding claim, in which the depositions of step c) are carried out at a temperature of between 600°C and 900°C, indeed even preferentially between 700°C and 800°C.
3. Manufacturing process according to either of the preceding claims, in which the depositions of step c) are based on an atmospheric pressure, low-pressure or plasma-enhanced chemical vapour deposition technique.
4. Manufacturing process according to one of the preceding claims, in which the n depositions of step c) are carried out at n increasing temperatures.
5. Manufacturing process according to one of Claims 1 to 3, in which the n depositions of step c) are carried out at n decreasing temperatures.
6. Manufacturing process according to one of the preceding claims, in which at least two carrier layers ~~(20')~~ from the n carrier layers ~~(20')~~ deposited in step c) exhibit different doping levels.
7. Manufacturing process according to one of the preceding claims, in which, on conclusion of the depositions of step c), the carrier substrate ~~(20)~~ exhibits a thickness of greater than or equal to 50 microns, of greater than or equal to 100 microns, indeed even of greater than or equal to 200 microns.

8. Manufacturing process according to one of the preceding claims, in which step a) comprises the formation of a monocrystalline conversion layer ~~(13)~~ on the initial substrate ~~(11)~~, prior to the epitaxial growth of the donor layer ~~(110)~~, in order to convert defects of basal plane dislocation type of the initial substrate ~~(11)~~ into defects of threading edge dislocation type.
9. Manufacturing process according to one of the preceding claims, in which, in step a), the epitaxial growth of the donor layer ~~(110)~~ is carried out at a temperature of greater than 1200°C, preferentially of between 1500°C and 1650°C.
10. Manufacturing process according to one of the preceding claims, in which, in step c), at least one among the n steps of formation of the carrier layers ~~(20')~~ comprises an annealing carried out after the chemical vapour deposition of the step, the temperature of the annealing being greater than the deposition temperature and less than a separation temperature liable to bring about the separation of step d).
11. Manufacturing process according to one of the preceding claims, in which a chemical etching, a mechanical lapping and/or a chemical mechanical polishing is (are) applied to a rear face ~~(20b)~~ of the carrier substrate ~~(20)~~, between step c) and step d).
12. Manufacturing process according to one of the preceding claims, in which a new chemical vapour deposition is carried out after the separation of step d), in order to thicken the carrier substrate ~~(20)~~.

13. Manufacturing process according to one of the preceding claims, in which step e) comprises a simultaneous chemical mechanical polishing of a front face ~~(10a)~~ and of a rear face ~~(20b)~~ of the composite structure ~~(1)~~.
14. Manufacturing process according to one of the preceding claims, comprising a step of reconditioning the remainder ~~(111')~~ of the donor substrate for the purpose of reuse as initial substrate ~~(11)~~ or as donor substrate ~~(111)~~.