

CLAIMS

1. A Ssemiconductor structure—(100) comprising a working layer
~~(10)~~ made of monocrystalline semiconductor material,
 extending in a main plane—(x,y), a carrier substrate—(30)
 made of semiconductor material, and an interface zone—(20)
 between the working layer—(10) and the carrier substrate
~~(30)~~, extending parallel to the main plane—(x,y), the
 structure—(100) being characterized in that the interface
 zone—(20) comprises nodules—(21):
 - that are electrically conductive, comprising a metal
 material forming an ohmic contact with the working layer
~~(10)~~ and with carrier substrate—(30),
 - that have a thickness, along an axis—(z) normal to the main
 plane—(x,y), that is less than or equal to 30 nm,
 - that are disjunct or joined, the disjunct nodules—(21) being
 separated from one another by regions of direct contact—(22)
 between the working layer—(10) and the carrier substrate
~~(30)~~.
2. The Ssemiconductor structure—(100) according to the
 preceding claim, wherein the working layer—(10) and the
 carrier substrate—(30) are formed of the same semiconductor
 material and have an identical doping type.
3. The Ssemiconductor structure—(100) according to either of
 the preceding claims, wherein the semiconductor material of
 the working layer—(10) is chosen from among silicon carbide,
 silicon, gallium nitride and germanium.
4. The Ssemiconductor structure—(100) according to one of the
 preceding claims, wherein the semiconductor material of the
 carrier substrate—(30) is chosen from among silicon carbide,

silicon, gallium nitride and germanium, and has a monocrystalline, polycrystalline or amorphous structure.

5. The Ssemiconductor structure—~~(100)~~ according to one of the preceding claims, wherein the metal material of the nodules ~~(21)~~ is chosen from among tungsten, titanium, nickel, aluminium, molybdenum, niobium, tantalum, cobalt and copper.
6. The Ssemiconductor structure—~~(100)~~ according to one of the preceding claims, wherein the degree of coverage of the nodules—~~(21)~~ in a median plane—~~(P)~~ of the interface zone ~~(20)~~ is between 1% and 70%.
7. The Ssemiconductor structure—~~(100)~~ according to one of the preceding claims, wherein the nodules—~~(21)~~ have a resistivity lower than 0.1 mohm.cm², preferably lower than or equal to 0.01 mohm.cm², so as to obtain a resistivity of the interface zone—~~(20)~~ lower than 0.1 mohm.cm², preferably lower than or equal to 0.01 mohm.cm².
8. The Ssemiconductor structure—~~(100)~~ according to one of the preceding claims, wherein the nodules—~~(21)~~ have a thickness of less than or equal to 20 nm, or even less than or equal to 10 nm.
9. A Ppower component produced on and/or in the working layer ~~(10)~~ of a—the semiconductor structure—~~(100)~~ according to one of the preceding claims, and comprising at least one electrical contact on and/or in the carrier substrate—~~(30)~~, at the level of a back face of the semiconductor substrate ~~(100)~~.

10. A Process for producing ~~a-the~~ semiconductor structure ~~(100)~~ according to one of Claims 1 to 8, comprising the following steps:
- a) providing a working layer ~~(10)~~ made of monocrystalline semiconductor material having a free face ~~(10a)~~ to be joined,
 - b) providing a carrier substrate ~~(30)~~ made of semiconductor material having a free face ~~(30a)~~ to be joined,
 - c) depositing a film ~~(2)~~ made of a metal material able to form an ohmic contact with the working layer ~~(10)~~ and with the carrier substrate ~~(30)~~ and having a thickness of less than or equal to 20 nm on the free face ~~(10a)~~ to be joined of the working layer ~~(10)~~ and/or on the free face ~~(30a)~~ to be joined of the carrier substrate ~~(30)~~ under a non-oxidizing controlled atmosphere,
 - d) forming an intermediate structure ~~(150)~~ comprising an operation of directly joining the free faces to be joined of the working layer ~~(10)~~ and of the carrier substrate ~~(30)~~, respectively, under a non-oxidizing controlled atmosphere, the intermediate structure ~~(150)~~ including an encapsulated film ~~(2')~~ originating from the one or more films ~~(2)~~ deposited in step c),
 - e) annealing the intermediate structure ~~(150)~~ at a temperature higher than or equal to a critical temperature, so as to cause the segmentation of the encapsulated film ~~(2')~~ into electrically conductive nodules ~~(21)~~ forming an ohmic contact with the working layer ~~(10)~~ and with the carrier substrate ~~(30)~~, and form the interface zone ~~(20)~~.
11. The Production process according to ~~the preceding~~ claim 10, wherein the working layer ~~(10)~~ and the carrier substrate ~~(30)~~ are formed of the same semiconductor material and have an identical doping type.

12. The Production process according to ~~either of the two preceding~~ claims 10 or 11, wherein step a) comprises an operation of implanting light species into a donor substrate ~~(1)~~ so as to form a buried weakened plane ~~(11)~~ that delimits, with a front face ~~(10a)~~ of the donor substrate ~~(1)~~, the working layer ~~(10)~~.
13. The Production process according to ~~the preceding~~ claim 12, wherein step a) comprises the formation of the donor substrate ~~(1)~~ by epitaxially growing a donor layer ~~(1')~~ on an initial substrate, the implantation being performed later, into the donor layer ~~(1')~~.
14. The Production process according to ~~either of the two preceding~~ claims 12 or 13, wherein step d) comprises, after the direct joining giving rise to a bonded assembly ~~(200)~~ comprising the donor substrate ~~(1)~~ and the carrier substrate ~~(30)~~, a separation at the level of the buried weakened plane ~~(11)~~ so as to form, on the one hand, the intermediate structure ~~(150)~~ comprising the working layer ~~(10)~~, the encapsulated film ~~(2')~~ and the carrier substrate ~~(30)~~ and, on the other hand, the remainder of the donor substrate ~~(1'')~~.
15. The Production process according to any one of ~~the five preceding~~ claims 10 to 14, comprising, prior to deposition step c), a step c') of deoxidation of the free face ~~(10a)~~ to be joined of the working layer ~~(10)~~ and/or of the free face ~~(30a)~~ to be joined of the carrier substrate ~~(30)~~.
16. The Production process according to any one of ~~the six preceding~~ claims 10 to 15, wherein the deposition of

step c) and the direct joining of step d) are performed in one in the same apparatus.

17. The Production process according to any one of ~~the seven preceding~~ claims 10 to 16, wherein the thickness of the film ~~(2)~~ deposited in step c) is less than or equal to 10 nm, or even less than or equal to 5 nm, or even less than or equal to 2 nm.
18. The Production process according to any one of ~~the eight preceding~~ claims 10 to 17, wherein steps c) and d) are performed in vacuum.
19. The Production process according to any one of ~~the nine preceding~~ claims 10 to 18, wherein deposition step c) is performed at ambient temperature, using a sputtering technique.
20. The Production process according to any one of ~~the ten preceding~~ claims 10 to 19, wherein the critical temperature is between 500°C and 1800°C, depending on the nature of the metal material of the encapsulated film ~~(2)~~ and of the one or more semiconductor materials of the working layer ~~(10)~~ and of the carrier substrate ~~(30)~~.