

Such a production process is, however, not compatible when the material forming the carrier substrate is p-SiC requiring deposition at temperatures above 1200°C (usual temperatures for the production of p-SiC). Specifically, at these high temperatures, the growth kinetics of the cavities present in the buried weakened plane are faster than the growth kinetics of the p-SiC layer and the thickness required for a stiffening effect is not reached before blistering starts to occur, which is related to the deformation of the layer vertically in line with the cavities.

SUBJECT OF THE INVENTION

The present invention relates to an alternative solution to those of the prior art, and aims to completely or partly overcome the abovementioned drawbacks. In particular, it relates to a temporary substrate that is detachable at very high temperatures and to an associated production process; it further relates to a process for transferring a working layer, which may in particular be made of monocrystalline silicon carbide, from the temporary substrate to a receiver substrate, in order to form a composite structure.

BRIEF DESCRIPTION OF THE INVENTION

An aspect of the invention ~~relates to~~ provides a temporary substrate, which is detachable at a detachment temperature higher than 1000°C and comprises:

- a semiconductor working layer extending along a main plane,
- a carrier substrate,
- an intermediate layer arranged between the working layer and the carrier substrate, and having a thickness, along an axis normal to the main plane, less than 20 nm,

- a bonding interface located in the intermediate layer or adjacent thereto,
- atoms of at least one gaseous species that are distributed according to a concentration profile along the axis normal to the main plane, with a maximum concentration higher than $10^{21}/\text{cm}^3$, said atoms remaining trapped in the intermediate layer and/or in an adjacent layer of the carrier substrate with a thickness less than or equal to 10 nm and/or in an adjacent sublayer of the working layer with a thickness less than or equal to 10 nm when the temporary substrate is subjected to a temperature lower than the detachment temperature, and said atoms being intended to diffuse to a detachment interface when the temporary substrate is subjected to a temperature higher than or equal to the detachment temperature.

According to other advantageous and non-limiting features of the invention, taken alone or in any technically feasible combination:

- the working layer comprises silicon carbide, diamond and/or gallium nitride;
- the intermediate layer is formed by at least one material chosen from among tungsten, nickel, titanium, aluminium, molybdenum, tantalum, titanium nitride, tantalum nitride, amorphous silicon;
- the gaseous species is nitrogen, helium, argon, xenon and/or hydrogen;
- the carrier substrate comprises a material the coefficient of thermal expansion of which is equal to or close to that of the working layer.

Another aspect of the invention also relates to provides a process for producing a temporary substrate as above, comprising:

- a) a step of providing a donor substrate,

layer, to convert basal plane dislocation defects of the initial substrate into threading edge dislocation defects, prior to the epitaxial growth of the donor layer;

- the epitaxial growth is performed at a temperature above 1200°C, preferentially between 1500°C and 1650°C;
- step f) comprises a heat treatment at a temperature of between 900°C and 1200°C.

~~Lastly, Another aspect of~~ the invention ~~relates to~~provides a process for transferring a working layer from a temporary substrate as above to a receiver substrate. The process comprises:

g) a step of forming a detachable structure comprising a receiver substrate arranged on the working layer of the temporary substrate, the formation step involving a treatment at a first temperature higher than or equal to 1000°C,

h) a step of detaching the detachable structure along a detachment interface in or adjacent to the intermediate layer, the detachment step comprising a heat treatment at a detachment temperature higher than the first temperature in order to form, on the one hand, a composite structure comprising the working layer arranged on the receiver substrate and, on the other hand, the carrier substrate.

According to other advantageous and non-limiting features of the invention, taken alone or in any technically feasible combination:

- step g) comprises the deposition of a receiver substrate on a free face of the working layer of the temporary substrate;
- the deposition of the receiver substrate is performed by, thermal or enhanced, chemical vapour deposition, or by evaporation, at a temperature higher than or equal to 1000°C, preferably higher than or equal to 1200°C;