CLAIMS

1. A ~~C~~composite structure ~~(100)~~, comprising:
   - a receiver substrate ~~(3)~~ comprising at least one cavity ~~(31)~~ defined in said substrate and devoid of solid material or filled with a sacrificial solid material,
   - a single-crystal semiconductor layer ~~(1)~~ placed on the receiver substrate ~~(3)~~, said layer having a free surface over the entire extent of the structure and a thickness comprised between 0.1 micron and 100 microns,
   - a piezoelectric layer ~~(2)~~ that is securely fastened to the single-crystal semiconductor layer ~~(1)~~ and placed between the latter and the receiver substrate ~~(3)~~,
   at least one segment of the single-crystal semiconductor layer ~~(1)~~ being intended to form a movable membrane ~~(50)~~ above the cavity ~~(31)~~, when the latter is devoid of solid material or after the sacrificial solid material has been removed,
   and the piezoelectric layer ~~(2)~~ being intended to cause or to detect the deformation of said membrane ~~(50)~~.

2. The c~~C~~omposite structure ~~(100)~~ according to the preceding claim, wherein the piezoelectric layer ~~(2)~~ comprises a material chosen from lithium niobate (LiNbO3), lithium tantalate (LiTaO3), potassium-sodium niobate ($K_xNa_{1-x}NbO_3$ or KNN), barium titanate (BaTiO3), quartz, lead zirconate titanate (PZT), a compound of lead-magnesium niobate and of lead titanate (PMN-PT), zinc oxide (ZnO), aluminium nitride (AlN), and aluminium-scandium nitride (AlScN).

3. The ~~C~~composite structure ~~(100)~~ according to one of the preceding claims, wherein the piezoelectric layer ~~(2)~~ has a thickness smaller than 10 microns, and preferably smaller than 5 microns.

4. The ~~C~~composite structure ~~(100)~~ according to one of the preceding claims, wherein the single-crystal semiconductor layer ~~(1)~~ is made of silicon or of silicon carbide.

5. The ~~C~~composite structure ~~(100)~~ according to one of the preceding claims, wherein the piezoelectric layer ~~(2)~~ is placed solely facing the - at least one - cavity ~~(31)~~ of the receiver substrate ~~(3)~~.

6. The ~~C~~composite structure ~~(100)~~ according to one of Claims 1 to 4, wherein the piezoelectric layer ~~(2)~~ is placed facing the - at least one - cavity ~~(31)~~ of the receiver substrate ~~(3)~~ and is securely fastened to the receiver substrate ~~(3)~~ beyond the - at least one - cavity ~~(31)~~.

7. A ~~D~~device ~~(150)~~ based on a movable membrane ~~(50)~~ above a cavity ~~(31)~~, said device being formed from the composite structure ~~(100)~~ according to one of the preceding claims, and comprising at least two electrodes ~~(21, 22)~~ making contact with the piezoelectric layer ~~(2)~~, wherein:
- the cavity ~~(31)~~ is devoid of solid material,
- and at least one segment of the single-crystal semiconductor layer ~~(1)~~ forms the movable membrane ~~(50)~~ above the cavity ~~(31)~~.

8. A ~~P~~process for fabricating a composite structure ~~(100)~~ according to one of Claims 1 to 6, comprising the following steps:
a) providing a donor substrate ~~(10)~~ comprising a single-crystal semiconductor layer ~~(1)~~ that is bounded between a front side ~~(10a)~~ of the donor substrate ~~(10)~~ and a buried weak plane ~~(11)~~ in said donor substrate ~~(10)~~, said layer

~~(1)~~ having a thickness comprised between 0.1 micron and 100 microns,

b) providing a receiver substrate ~~(3)~~ comprising at least one cavity ~~(31)~~ defined in said substrate and opening onto a front side ~~(3a)~~ of the receiver substrate ~~(3)~~, the cavity ~~(31)~~ being devoid of solid material or filled with a sacrificial solid material,

c) forming a piezoelectric layer ~~(2)~~ so that it is placed on the front side ~~(10a)~~ of the donor substrate ~~(10)~~ and/or on the front side ~~(3a)~~ of the receiver substrate ~~(3)~~,

d) joining the donor substrate ~~(10)~~ and the receiver substrate ~~(3)~~ via their respective front sides,

e) cleaving, along the buried weak plane ~~(11)~~, the single-crystal semiconductor layer ~~(1)~~ from the rest ~~(11')~~ of the donor substrate, in order to form the composite structure ~~(100)~~ comprising the single-crystal semiconductor layer ~~(1)~~, the piezoelectric layer ~~(2)~~ and the receiver substrate ~~(3)~~.

9. The ~~F~~fabrication process according to ~~the preceding~~ claim 8, wherein the buried weak plane ~~(11)~~ is formed by implanting light species into the donor substrate ~~(10)~~, and the cleave along the buried weak plane ~~(11)~~ is obtained via a heat treatment and/or via the application of a mechanical stress.

10. The ~~F~~fabrication process according to Claim 8, wherein the buried weak plane ~~(11)~~ is formed by an interface having a bonding energy lower than 0.7 J/m^2.

11. The ~~F~~fabrication process according to one of ~~the three preceding~~ claims 8 to 10, comprising a step of forming metal electrodes ~~(21, 22)~~ before and/or after step c), so

that said electrodes make contact with the piezoelectric layer ~~(2)~~.

12. The ~~F~~fabrication process according to one of ~~the four preceding~~ claims 8 to 11, wherein step c) comprises, when the piezoelectric layer ~~(2)~~ is formed on the front side ~~(10a)~~ of the donor substrate ~~(10)~~, a local etch of said piezoelectric layer ~~(2)~~, so as to preserve the piezoelectric layer ~~(2)~~ solely facing the - at least one - cavity ~~(31)~~ at the end of the joining step, step d).