In one aspect, there is provided a method for manufacturing, by means of epitaxy, a monocrystalline useful layer (3; 3', 3") of GaN on a substrate (1) wherein the coefficient of thermal expansion is less than the coefficient of thermal expansion of GaN, said substrate (1) being thus suitable for generating tensile strain in said useful layer, characterised in that it comprises the following successive steps:

(a) formation, on the substrate (1), of a buffer layer (2) of AlN,

(b) three-dimensional epitaxial growth, directly on the buffer layer (2), of a layer (3a) of GaN relaxed at the epitaxial temperature,

(c1) epitaxial growth, on the layer (3a) of GaN, of a first intermediate layer (4a) having the composition $B_wAl_xGa_yIn_zN$, where $w+x+y+z=1$ and $0.5<x\leq 1$, $0\leq y<1$, $0\leq w<1$ and $0\leq z<1$,

(c2) epitaxial growth of a layer (3b) having the composition $B_wAl_xGa_yIn_zN$, where $w+x+y+z=1$ and $0\leq x<0.5$, $0\leq y<1$, $0\leq w<1$ and $0\leq z<1$,

(c3) epitaxial growth of a second intermediate layer (4b) having the composition $B_wAl_xGa_yIn_zN$, where $w+x+y+z=1$ and $0.5<x\leq 1$, $0\leq y<1$, $0\leq w<1$ and $0\leq z<1$,

at least one of the layers (3b, 4a, 4b) formed in steps (c1) to (c3) being an at least ternary III-N alloy comprising aluminium and gallium,

(d) epitaxial growth of said useful layer (3; 3', 3") of GaN.

In another aspect, there is provided a structure comprising a monocrystalline useful layer (3; 3', 3") of GaN on a substrate (1) wherein the coefficient of thermal expansion is less than the coefficient of thermal expansion of GaN, characterised in that it successively comprises:

- a monocrystalline layer (3a) of GaN under tensile strain at ambient temperature,

- a first monocrystalline intermediate layer (4a) having the composition $B_wAl_xGa_yIn_zN$, where $w+x+y+z=1$ and $0.5<x\leq 1$, $0\leq y<1$, $0\leq w<1$ and $0\leq z<1$,

- a monocrystalline layer (3b) having the composition $B_wAl_xGa_yIn_zN$, where $w+x+y+z=1$ and $0\leq x<0.5$, $0\leq y<1$, $0\leq w<1$ and $0\leq z<1$,

- a second monocrystalline intermediate layer (4b) having the composition $B_wAl_xGa_yIn_zN$, where $w+x+y+z=1$ and $0.5<x\leq 1$, $0\leq y<1$, $0\leq w<1$ and $0\leq z<1$,

- said useful layer (3; 3', 3") of GaN,

and in that at least one of the layers (3b, 4a, 4b) between the monocrystalline layer (3a) of GaN under tensile strain at ambient temperature and the useful layer (3; 3', 3") of GaN is made of an at least ternary III-N alloy comprising aluminium and gallium.

In another aspect, there is provided a self-supporting monocrystalline layer (3; 3', 3") of GaN having a thickness greater than or equal to 5 µm, a diameter greater than or equal to 150 mm and a dislocation density less than or equal to $5x10^8$ cm^{-2}, said layer being devoid of cracks.

In another aspect, there is provided a structure comprising a monocrystalline layer (3; 3', 3") of GaN on a substrate, said layer (3; 3', 3") of GaN having a thickness greater than or equal to 5 µm, a diameter greater than or equal to 150 mm and a dislocation density less than or equal to $5x10^8$ cm^{-2}.

In another aspect, there is provided an electronic, optoelectronic or micromechanical device formed in or on a useful layer (3; 3', 3") of GaN as defined above.