CLAIMS

1. A seed substrate for epitaxial growth comprising:

a support substrate;

a planarizing layer provided on an upper surface of the support substrate, the planarizing layer having a thickness of between 0.5 μm and 3.0 μm, inclusive; and

a seed crystal layer provided on an upper surface of the planarizing layer,

wherein the support substrate comprises:

a composite ceramic core composed of polycrystalline ceramics of Group III nitrides and at least one nitrides or oxides of Group III or IV, which is a fiber-shaped single crystal; and

an encapsulating layer that directly encapsulates the core, the encapsulating layer having a thickness of between 0.05 μm and 1.5 μm, inclusive, and

wherein the seed crystal layer is a layer of Si <111> single crystal of 0.04 to 1.5 μm and oxidation-induced stacking faults of 10 defects/cm^2 or less.

2. The seed substrate for epitaxial growth as claimed in claim 1, wherein the Group III nitride polycrystalline ceramics forming the core are AlN ceramics and the fiber-shaped single crystals are AlN, Si_3N_4 or Al_2O_3.

3. The seed substrate for epitaxial growth as claimed in claim 1 or 2, wherein the encapsulating layer includes at least a layer of Si_3N_4.

4. The seed substrate for epitaxial growth as claimed in any one of claims 1 to 3, wherein the planarizing layer is a monolayer film of either SiO_2, silicon oxynitride ($Si_xO_yN_z$) and AlAs, or a multilayer film of any combination of these.

5. The seed substrate for epitaxial growth as claimed in any one of claims 1 to 4, wherein the Si <111> single crystal forming the seed crystal layer has an electrical resistivity (at room temperature) of 1 kΩ-cm or higher.

6. The seed substrate for epitaxial growth as claimed in any one of claims 1 to 5, further comprising a stress adjusting layer on a bottom surface of the support substrate.

7. The seed substrate for epitaxial growth as claimed in claim 6, wherein the stress adjusting layer has a thermal expansion coefficient that enables further correction of the warpage after the planarizing layer is provided, and consists of polycrystalline Si prepared by a method selected from at least the sputtering, plasma CVD, and LPCVD.

8. The seed substrate for epitaxial growth as claimed in claim 6 or 7, wherein the stress adjusting layer is composed of polycrystalline Si provided immediately below a lower surface of the support substrate interposed by SiO_2 and/or silicon oxynitride ($Si_xO_yN_z$), and/or polycrystalline Si whose surface layer is partially nitrided.

9. The seed substrate for epitaxial growth as claimed in any one of claims 1 to 8, wherein the encapsulating layer is deposited by LPCVD.

10. The seed substrate for epitaxial growth as claimed in any one of claims 1 to 9, wherein the planarizing layer is formed by depositing SiO_2 and/or silicon oxynitride ($Si_xO_yN_z$) or AlAs on one of the top surfaces or the entire surface of the support substrate by one of plasma CVD, LPCVD, and low-pressure MOCVD.

11. The seed substrate for epitaxial growth as claimed in any one of claims 1 to 10, wherein the seed crystal layer is provided by ion implanting hydrogen and/or He into a Si<111> single crystal having oxidation-induced stacking faults of 10 defects/cm^2 or less and electrical resistivity (at room temperature) of 1 kΩ-cm or more, followed by peeling off asurface layer of the Si<111> single crystal by physical means at 450°C or less to perform thin-film transfer.

12. A semiconductor substrate on which a III-V semiconductor thin film is deposited on a top surface of a seed substrate for epitaxial growth according to any one of claims 1 to 11.

13. The semiconductor substrate as claimed in claim 12, wherein the III-V semiconductor thin film is a nitride semiconductor thin film containing Ga and/or Al.

14. A method for producing seed substrate for epitaxial growth comprising steps of:

preparing the composite ceramic core composed of a polycrystalline ceramics of Group III nitrides and at least one nitride or oxide of Group III or IV, which is a fiber-shaped single crystal;

obtaining a supporting substrate by depositing an encapsulating layer so as to directly wrap the core, the encapsulating layer having a thickness of between 0.05 μm and 1.5 μm, inclusive;

depositing a planarizing layer on an upper surface of the support substrate, the planarizing layer having a thickness of between 0.5 μm and 3.0 μm, inclusive; and

providing a seed crystal layer with a thickness of 0.04 to 1.5 μm by thin-film transfer of Si <111> single crystal having oxidation-induced stacking faults of 10 defects/cm2 or less on

a top surface of the planarizing layer.

15. The method for producing seed substrate for epitaxial growth as claimed in claim 14, wherein the encapsulating layer is deposited by the LPCVD.

16. The method for producing seed substrate for epitaxial growth as claimed in claim 14 or 15, wherein the planarizing layer is formed by depositing SiO_2 and/or silicon oxynitride ($Si_xO_yN_z$) or AlAs on one of the top surfaces or the entire surface of the support substrate by one of plasma CVD, LPCVD, and low-pressure MOCVD.

17. The method for producing seed substrate for epitaxial growth as claimed in any one of claims 14 to 16, wherein in the step of providing the seed crystal layer, the seed crystal layer is provided by ion implanting hydrogen and/or He into the Si<111> single crystal having oxidation-induced stacking faults of 10 defects/cm^2 or less and electrical resistivity (at room temperature) of 1 kΩ-cm or more, bonding the Si<111> single crystal to the top surface of the planarizing layer, and then peeling off a surface layer of the Si<111> single crystal by physical means at 450°C or less to perform the thin-film transfer.

18. The method for producing seed substrate for epitaxial growth as claimed in any one of claims 14 to 16, wherein in the step of providing the seed crystal layer, the seed crystal layer is provided by ion implanting hydrogen and/or He into the Si<111> single crystal having oxidation-induced stacking faults of 10 defects/cm^2 or less, followed by thin-film transfer of 0.20 to 1.7 μm of a surface layer of the Si<111> single crystal by physical means at 450°C or less, and adjusting the thickness to 0.04 to 1.5 μm.

19. The method for producing seed substrate for epitaxial growth as claimed in any one of claims 14 to 16, wherein in the step of providing the seed crystal layer, the seed crystal layer is provided by ion implanting hydrogen and/or He into the Si<111> single crystal having oxidation-induced stacking faults of 10 defects/cm^2 or less and electrical resistivity (at room temperature) of 1 kΩ-cm or more, followed by thin-film transfer of 0.20 to 1.7 μm of a surface layer of the Si<111> single crystal by physical means at 450°C or less, and adjusting the thickness to 0.04 to 1.5 μm.

20. The method for producing seed substrate for epitaxial growth as claimed in claim 18 or 19, wherein in the step of providing the seed crystal layer, the thickness of the seed crystal layer is adjusted to 0.04 to 1.5 μm by CMP polishing and/or etching with a chemical solution on the thin-film transferred Si <111> single crystal.

21. The method for producing seed substrate for epitaxial growth as claimed in any one of claims 14 to 20, further providing a stress adjusting layer on a bottom surface of the support substrate.

22. The method for producing seed substrate for epitaxial growth as claimed in claim 21, wherein the stress adjusting layer has a thermal expansion coefficient that enables further correction of the warpage after the planarizing layer is provided, and consists of polycrystalline Si prepared by a method selected from at least the sputtering, plasma CVD, and LPCVD method and/or polycrystalline Si whose surface layer is partially nitrided in a nitriding atmosphere.

23. A method for producing semiconductor substrate comprising

steps of:

producing a seed substrate for epitaxial growth by the method for producing a seed substrate for epitaxial growth as claimed in any one of claims 14 to 22; and

depositing a III-V group semiconductor thin film on the top surface of the seed substrate for epitaxial growth.