

CLAIMS

1. A method for manufacturing a composite substrate for forming a nanocarbon film by sublimation process, comprising:

implanting ion from a surface of a single crystal silicon carbide substrate to form an ion-implanted region;

bonding an ion-implanted surface of the single crystal silicon carbide substrate and a main surface of a handle substrate,

peeling the single crystal silicon carbide substrate at the ion-implanted region to transfer a single crystal silicon carbide thin film onto the handle substrate, and

forming a thin film formed of at least one kind of metal material selected from Ti, Au, Ag, Cu, Ni, Co, Fe, Cr, Zr, Mo, Ta and W on the ion-implanted surface of the single crystal silicon carbide substrate and/or the main surface of the handle substrate; and adjusting the surface roughness RMS of the surface of the thin film to 0.90 nm or less

wherein the surface to be bonded of the single crystal silicon carbide substrate and the surface to be bonded of the handle substrate each has a surface roughness RMS of 0.90 nm or less.

2. The method for manufacturing a composite substrate for forming a nanocarbon film by sublimation process according to claim 1, wherein the handle substrate is formed of a heat resistant material having a heat resistance temperature of 1,100°C or more (except for single crystal silicon carbide).

3. The method for manufacturing a composite substrate for forming a nanocarbon film by sublimation process according to claim 1 or 2, wherein the handle substrate is formed of an amorphous silicon carbide or a polycrystalline silicon carbide.

4. The method for manufacturing a composite substrate for forming a nanocarbon film by sublimation process according to any one of claims 1 to 3, comprising forming a thin film formed of at least one kind of material selected from silicon oxide, silicon nitride, aluminum oxide, aluminum nitride, zirconium oxide, silicon and silicon carbide on the ion-implanted surface of the single crystal silicon carbide substrate and/or the main surface of the handle substrate; and polishing the thin film to thereby adjust the surface roughness RMS of the surface of the thin film to 0.90 nm or less.

5. The method for manufacturing a composite substrate for forming a nanocarbon film by sublimation process according to any one of claims 1 to 4, comprising subjecting the surface to be bonded of the silicon carbide substrate and/or the surface to be bonded of the handle substrate to a surface activation treatment, and conducting the bonding.

6. The method for manufacturing a composite substrate for forming a nanocarbon film by sublimation process according to claim 5, wherein the surface activation treatment is a plasma activation treatment, a vacuum ion beam treatment or an immersion treatment in ozone water.

7. The method for manufacturing a composite substrate for forming a nanocarbon film by sublimation process according to any one of claims 1 to 6, comprising bonding the single crystal silicon carbide substrate and the handle substrate, and applying a physical impact to the ion-implanted region to thereby peel the single crystal silicon carbide substrate.

8. A composite substrate comprising:
a single crystal silicon carbide thin film;

a handle substrate formed of an amorphous silicon carbide; and

an intermediate layer disposed between the single crystal silicon carbide thin film and the handle substrate.

9. The composite substrate according to claim 8, wherein the thickness of the single crystal silicon carbide thin film is from 100 to 2,000 nm.

10. The composite substrate according to any one of claims of 8 or 9, wherein the material for constituting the intermediate layer is selected from silicon oxide, silicon nitride, alumina, aluminum nitride, zirconium oxides, silicon, and silicon carbides, and the thickness of the intermediate layer is from 2 to 400 nm.

11. The composite substrate according to any one of claims 8 or 9, wherein the material for constituting the intermediate layer is selected from Ti, Au, Ag, Cu, Ni, Co, Fe, Cr, Zr, Mo, Ta, and W, and the thickness of the intermediate layer is from 2 to 200 nm.