Claims

1. A refractory carbide multilayer (10) comprising a first layer (11), a second layer (12) and a third layer (13), wherein

   the first layer (11) has an average thickness of at least 25 nm and contains at least one refractory carbide,

   the second layer (12) has an average thickness of at least 25 nm and contains at least one refractory carbide,

   the third layer (13) has an average thickness of at least 25 nm and contains at least one refractory carbide, and

   the first layer (11) has a larger mean linear intercept section grain size than the second layer (12);

   and wherein the second layer (12) is arranged between the first layer (11) and the third layer (13), and the third layer (13) has a larger mean linear intercept section grain size than the second layer (12).

2. Device for high temperature applications, wherein the device comprises a multilayer (10) of claim 1 on a surface of a material of the device.

3. The multilayer (10) according to claim 1 or the device according to claim 2, wherein at least one refractory carbide of at least one of the layers comprises a silicon carbide, tantalum carbide, niobium carbide, hafnium carbide, tungsten carbide, boron carbide, tantalum niobium carbide, tantalum hafnium carbide, or a niobium hafnium carbide.

4. The multilayer (10) according to claim 1 or the device according to claim 2, wherein the second layer (12) contains more of a non-carbon constituent (e.g. silicon) of the refractory carbide (e.g. silicon carbide), than the first layer (11).

5. The multilayer (10) according to claim 1 or the device according to claim 2, wherein porosity of the second layer (12) exceeds porosity of the first layer (11).

6. The multilayer (10) according to claim 1 or the device according to claim 2, wherein the first layer (11) is sandwiched between the second layer (12) and the third layer (13), and the first layer (11) has a larger mean linear intercept section grain size than the third layer (13).

7. The multilayer (10) according to claim 1 or the device according to claim 2, wherein

- the average thickness of every individual layer is in a range from 0.025µm to 500 µm for every layer which is a layer of a multilayer (10) of the device, or
- the average thickness of every individual layer is in a range from 0.1 µm to 100 mm for every layer which is a layer of a free-standing multilayer (10).

8. The multilayer (10) according to claim 1 or the device according to claim 2 wherein an outer surface has a mean linear intercept surface grain size in a range from 0.1 to 50 µm.

9. Device according to claim 2, wherein the material of the device comprises graphite (2) or elemental silicon.

10. CVD method for preparing a multilayer (10) according to claim 1 or a device according to claim 2, comprising:

- forming a refractory carbide layer that contains more or less of a non-carbon constituent (e.g. silicon) of the refractory carbide (e.g. silicon carbide) than a neighboring layer, and/or
- forming a refractory carbide layer having another porosity than a neighboring layer.

11. CVD method according to claim 10, wherein forming the refractory carbide layer that contains more or less of the non-carbon constituent (e.g. silicon) of the refractory carbide (e.g. silicon carbide) than the neighboring layer, and/or forming the refractory carbide layer having another porosity than the neighboring layer comprises depositing the refractory carbide layer that contains more or less of the non-carbon constituent (e.g. silicon) of the refractory carbide (e.g. silicone carbide) than the neighboring layer, and/or

depositing the refractory carbide layer having another porosity than the neighboring layer under conditions of

atmosphere composition,

pressure, and/or

temperature of the CVD coating atmosphere

that differ from the conditions of

atmosphere composition,

pressure, and/or

temperature of the CVD coating atmosphere

that are applied in a preceding or subsequent layer formation step.

12. CVD method according to claim 10, wherein depositing the refractory carbide layer having another porosity than the neighboring layer comprises depositing the refractory carbide layer having another porosity than the neighboring layer from a CVD coating atmosphere by altering a content of a carbon source.

13. CVD method according to claim 10, wherein

- forming the refractory carbide layer that contains more or less of the non-carbon constituent (e.g. silicon) of the refractory carbide (e.g. silicon carbide) than the neighboring layer, or
- forming the refractory carbide layer having another porosity than a neighboring layer, and depositing a layer having a larger mean linear intercept section grain size thereon until an outer surface of the layer having a larger mean linear intercept section grain size reaches a predefined mean linear intercept surface grain size.

14. Use of a multilayer (10) according to at least one of claims 1 to 9 as a coating of a support for increasing the lifetime of a support in an etching gas containing atmosphere and/or when exposed to mechanical stress.