Claims

1. A metallic substrate with a multi-layer coating, comprising in order:
   i) the metallic substrate;
   ii) a seed layer;
   iii) a barrier layer comprising DLC deposited via a CVD method; and
   iv) a functional layer comprising ta-C deposited via a PVD method; and

wherein the overall thickness of the coating is 5µm or less; wherein the substrate comprises multiple alternating barrier layers and functional layers; and wherein the thickness of each barrier layer is 0.5µm or less.

2. A coated substrate according to claim 1 comprising alternating layers of up to 10 barrier layers and up to 10 functional layers

3. A coated substrate according to claim 1 or 2 which further comprises an intermediate layer between the seed layer ii) and the barrier layer iii)

4. A coated substrate according to claim 3 wherein the intermediate layer comprises ta-C.

5. A coated substrate according to any of claims 1 to 4 wherein the total thickness of all barrier layers in the substrate is up to 1.0µm.

6. A coated substrate according to any of claims 1 to 5 wherein the thickness of the functional layer is from 0.1µm to 3µm.

7. A coated substrate according to any of claims 1 to 6 wherein the thickness of the seed layer is from 0.05µm to 2µm.

8. A coated substrate according to any of claims 1 to 7 wherein the functional layer(s) is/are deposited by FCVA.

9. A coated substrate according to any of claims 1 to 8 wherein the seed layer is formed from Cr, W, Ti, NiCr, Si or mixtures thereof.

10. A coated substrate according to any of claims 1 to 9 wherein the substrate is a steel substrate.

11. A coated substrate according to claim 10 wherein the substrate comprises stainless steel, HSS, tool steel or alloy steel.

12. A coated substrate according to any of claims 1 to 9 wherein the substrate comprises Ti, an alloy of Ti, Al or an alloy of Al.

13. A coated substrate according to any of claims 1 to 12, comprising at least 2 barrier layers and at least 2 functional layers.

14. A coated substrate according to any of claims 1 to 13, comprising at least 3 barrier layers and at least 2 functional layers.

15. A coated substrate according to any of claims 1 to 14, wherein the barrier layer comprising DLC has a hydrogen content of 20% or greater.

16. A coated substrate according to any of claims 1 to 15, wherein the functional layer comprising ta-C has a hydrogen content of less than 10%.

17. The metallic substrate with a multi-layer coating according to claim 1 comprising in order:

i) the metallic substrate wherein the metallic substrate is a steel substrate;

ii) the seed layer having a thickness from 0.05µm to 2µm;

iii) the barrier layer deposited by a CVD method, the barrier layer comprising DLC and having a thickness of 0.5µm or less; and

iv) the functional layer comprising ta-C deposited by CVA and having a thickness of from 0.1µm to 3µm;

wherein there are multiple alternating barrier layers (iii) and functional layers (iv).

18. The metallic substrate with a multi-layer coating according to claim 1 comprising in order:

i) the metallic substrate wherein the metallic substrate is a steel substrate;

ii) the seed layer having a thickness from 0.05µm to 2µm;

iii) an intermediate layer comprising ta-C having a thickness of from 0.1µm to 1.0µm;

iv) the barrier layer deposited by a CVD method, the barrier layer comprising DLC and having a thickness of 0.5µm or less; and

v) the functional layer comprising ta-C deposited by CVA and having a thickness of from 0.1µm to 3µm;

wherein there are multiple alternating barrier layers (iv) and functional layers (v).

19. A method of coating a metallic substrate, the method comprising

i) depositing onto the substrate a seed layer;

ii) depositing onto the substrate a layer of DLC having a thickness of 0.5µm or less via a CVD method; and

iii) depositing onto the substrate a layer of ta-C via a PVD method; and

iv) repeating steps ii) and iii).