CLAIMS

What is claimed is:

1. A cutter element for a drill bit, comprising:

a substrate having a longitudinal axis;

a first layer of polycrystalline diamond coupled to the substrate; and

a second layer of polycrystalline diamond coupled to the first layer at a first coherent boundary; wherein the first layer is axially positioned between the substrate and the second layer, and wherein the first layer has a first lattice constant; the second layer has a second lattice constant; whereby the second lattice constant is different from the first lattice constant.

2. The cutter element of claim 1, further comprising a third layer of polycrystalline diamond attached to the second layer at a second coherent boundary; wherein the second layer is axially positioned between the first layer and the third layer.

~~3. The cutter element of claim 1, wherein the first layer has a first lattice constant; the second layer has a second lattice constant; whereby the second lattice constant is different from the first lattice constant.~~

~~4.~~3. The cutter element of claim 2, wherein said third layer has a third lattice constant, wherein the third lattice constant is different from the second lattice constant.

~~5.~~4. The cutter element of claim 1, wherein the difference between the first and the second lattice constant is less that 10%.

~~6.~~5. The cutter element of claim ~~4~~3, wherein the difference between the second and the third lattice constant is less that 10%.

~~7.~~6. The cutter element of claim 1, wherein the first layer has a first particle size; the second layer has a second particle size; whereby the second particle size is different from the first particle size.

~~8.~~7. The cutter element of claim 2, wherein the third layer has a third particle size; whereby the third particle size is different from the second particle size.

~~9.~~8. The cutter element of claim 1, wherein at least one said layer is doped with a dopant selected from the group consisting of Al, B, N, Ti, P, and Zr.

~~10.~~9. The cutter element of claim 2, wherein at least one said layer is doped with a dopant selected from the group consisting of Al, B, N, Ti, P, and Zr.

~~11.~~10. The cutter element of claim ~~9~~8, wherein the layer is doped in an amount of about 0.01 atomic percent to about 10 atomic percent of said dopant.

~~12.~~11. The cutter element of claim ~~9~~8, wherein said layer is doped with B.

~~13.~~12. The cutter element of claim ~~12~~11, wherein B is in an amount of less than about 0.5 atomic percent.

~~14.~~13. The cutter element of claim ~~10~~9, wherein the layer is doped in an amount of about 0.01 atomic percent to about 10 atomic percent of said dopant.

~~15.~~14. The cutter element of claim ~~10~~9, wherein said layer is doped with B.

~~16.~~15. The cutter element of claim ~~15~~14, wherein B is in an amount of less than about 0.5 atomic percent.

~~17.~~16. A method of applying polycrystalline diamond layers on a substrate, comprising:

(a) loading a container with a first volume of polycrystalline diamond material with a first lattice constant;

(b) loading the container with at a second volume of polycrystalline diamond material with a second lattice constant, after (a), wherein said second lattice constant is different from said first lattice constant;

(c) loading a volume of a substrate material after (b);

(d) sintering each said volume of material by applying high temperature and high pressure; and

(e) forming a first coherent boundary between said first volume and said second volume.

~~18.~~17. The method of claim ~~17~~16, further comprising: loading said container with a third volume of polycrystalline diamond material with a third lattice constant, after (b) and before (c), wherein said third lattice constant is different to said second lattice constant; and forming a second coherent boundary between said second volume and said third volume.

~~19.~~18. The method of claim ~~17~~16, wherein said loading is by chemical vapor deposition.

~~20.~~19. The method of claim ~~17~~16, wherein said loading is by solid state liquid diffusion.

~~21.~~20. The method of claim ~~17~~16 wherein said high temperature is a temperature greater than about 1,200K.

~~22.~~21. The method of claim ~~17~~16 wherein said high pressure is a pressure greater than about 7 Gpa.

~~23.~~22. The method of claim ~~18~~17, wherein said loading is by chemical vapor deposition.

~~24.~~23. The method of claim ~~18~~17, wherein said loading is by solid state diffusion.

~~25.~~24. The method of claim ~~18~~17, wherein said high temperature is a temperature greater than about 1,200K.

~~26.~~25. The method of claim ~~18~~17, wherein said high pressure is a pressure greater than about 7 Gpa.

~~27.~~26. A drill bit for drilling a borehole in earthen formations, the bit comprising:

a plurality of cutter elements mounted on the bit, wherein said cutter elements comprise:

a substrate having a longitudinal axis;

a first layer of polycrystalline diamond coupled to the substrate;

a second layer of polycrystalline diamond coupled to said first layer at a first coherent boundary; wherein the first layer is axially positioned between the substrate and the second layer, and wherein the first layer has a first lattice constant; the second layer has a second lattice constant; whereby the second lattice constant is different from the first lattice constant.

~~28.~~27. The drill bit of claim ~~27~~26, wherein said cutter elements further comprise a third layer of polycrystalline diamond coupled to the second layer at a second coherent boundary; wherein the second layer is axially positioned between the first layer and the third layer.