CLAIMS:

1. A device configured to convert or amplify a particle, the conversion or amplification being reliant on the impact of a particle on a surface of the device causing the emission of one or more secondary electrons from the same surface, wherein the device is a conversion dynode or an amplification dynode or a microchannel wafer or a microchannel plate configured to operate in reflection mode comprisinges a carbon-based layer capable of secondary electron emission upon impact of a particle, and wherein the carbon-based layer is doped to confer or increase conductivity and is formed by a growth process on a substrate and subject to a post growth modification which causes termination of the carbon atoms.

~~2. The device of claim 2, wherein the device is a conversion dynode or an amplification dynode or a microchannel wafer or a microchannel plate.~~

~~3. The device of claim 1 or claim 2, wherein the conversion dynode or amplification dynode or microchannel wafer or microchannel plate is configured to operate in reflection mode.~~

24. The device of claim 1~~any one of claims 1 to 3~~, wherein the carbon-based layer is a diamond layer or a diamond-like carbon layer.

~~5. The device of any one of claims 1 to 4, wherein the carbon-based layer is doped to confer or increase conductivity.~~

36. The device of claim 1 or claim 2~~5~~, wherein the dopant is boron.

47. The device of any one of claims 1 to 3~~6~~, wherein the carbon-based layer has a crystalline structure.

58. The device of any one of claims 1 to 4~~7~~, wherein the carbon-based layer has a minimum thickness to provide for a required secondary electron yield.

6~~9~~. The device of any one of claims 1 to 5~~8~~, wherein the carbon-based layer has a thickness of less and about 5 nm, or less than about 1 nm, or between about 1 nm and about 500 nm, or between about 1 nm and about 100 nm.

~~10. The device of any one of claims 1 to 9, wherein the carbon-based layer is formed by a growth process on a substrate.~~

7~~11~~. The device of any one of claims 1 to 6~~claim 10~~, wherein the growth process is a deposition process.

8~~12~~. The device of claim 7~~11~~, wherein the deposition process is a vapour deposition process.

9~~13~~. The device of any one of claims 1 to 8~~10 to 12~~, wherein the carbon-based layer formed by growth on a substrate is subjected to post-growth modification.

10~~14~~. The device of claim 9~~13~~, wherein the post-growth modification increases the negative electron affinity of at least a portion of the carbon atoms of the carbon-based layer.

11~~15~~. The device of any one of claims 1 to 10~~10 to 14~~, wherein the termination is hydrogen termination ~~post-growth modification causes termination (such as hydrogen termination) of the carbon atoms of the carbon-based layer~~.

12~~16~~. The device of any one of claims 1 to 11~~10 to 15~~, wherein the post-growth modification is by exposure of the carbon-based layer to a gas plasma.

13~~17~~. The device of claim 12~~16~~, wherein the gas plasma is generated from hydrogen gas.

14~~18~~. The device of claim 12~~16~~ or claim 13~~17~~, wherein the gas plasma is generated by heating a gas.

15~~19~~. The device of any one of claims 1 to 14~~18~~, wherein the substrate is a metal.

16~~20~~. The device of claim 15~~19~~, wherein the metal is a transition metal.

17~~21~~. The device of claim 16~~20~~, wherein the transition metal is a second row or third row transition metal.

18~~22~~. The device of claim 17~~21~~, wherein the second row transition metal is molybdenum, or the third row transition metal is tungsten.

19~~23~~. An ion detector, electron multiplier, or photomultiplier comprising the device of any one of claims 1 to 18~~22~~.

20~~24~~. A mass spectrometer comprising the device of any one of claims 1 to 18~~23~~.

21~~25~~. A method for fabricating a device configured as a conversion dynode or an amplification dynode or a microchannel wafer or a microchannel plate ~~device~~ configured to convert or amplify a particle, the conversion or amplification being reliant on the impact of a particle on a surface of the device causing the emission of one or more secondary electrons from the same surface, the method comprising the steps of providing a substrate suitable for use in a reflection mode dynode or a microchannel wafer or a microchannel plate, and forming a carbon-based layer on the substrate by a growth process with a dopant to increase conductivity, wherein the carbon-based layer formed by growth on the substrate is subjected to a post-growth modification step to cause termination of at least a portion of the carbon atoms of the carbon-based layer.

~~26. The method of claim 25, wherein the substrate is suitable for use in a reflection mode dynode or a microchannel wafer or a microchannel plate.~~

~~27. The method of claim 25 or claim 26, wherein the dynode is a conversion dynode or an amplification dynode or a microchannel wafer or a microchannel plate.~~

22~~28~~. The method of claim 21~~any one of claims 25 to 27~~, wherein the carbon-based layer is a diamond layer or a diamond-like carbon layer.

~~29. The device of any one of claims 25 to 28, wherein the carbon-based layer is formed with a dopant to increase conductivity.~~

23~~30~~. The method of claim 21 or claim 22~~claim 29~~, wherein the dopant is boron.

24~~31~~. The method of any one of claims 21 to 23~~25 to 30~~, wherein the carbon-based layer is formed as a monocrystalline diamond layer.

25~~32~~. The method of any one of claims 21 to 24~~25 to 31~~, wherein the carbon-based layer is formed so as to have a minimum thickness to provide for a required secondary electron yield.

26~~33~~. The method of any one of claims 21 to 25~~25 to 32~~, wherein the carbon-based layer is formed to have a thickness of less than about 5 nm, or less than about 1 nm, or between about 1 nm and about 500 nm, or between about 1 nm and about 100 nm.

~~34. The method of any one of claims 25 to 33, wherein the carbon-based layer is formed by a growth process on the substrate.~~

27~~35~~. The method of any one of claims 21 to 26~~claim 34~~, wherein the growth process is a deposition process.

28~~36~~. The method of claim 27~~35~~, wherein the deposition process is a vapour deposition process.

~~37. The method of any one of claims 34 to 36, wherein the carbon-based layer formed by growth on the substrate is subjected to a post-growth modification step.~~

29~~38~~. The method of any one of claims 21 to 28~~claim 37~~, wherein the post-growth modification step increases the negative electron affinity of at least a portion of the carbon atoms of the carbon-based layer.

30~~39~~. The method of any one of claims 21 to 29~~claim 37 or claim 38~~, wherein the termination is hydrogen termination~~post-growth modification step causes termination (such as hydrogen termination) of at least a portion of the carbon atoms of the carbon-based layer~~.

31~~40~~. The method of any one of any one of claims 21 to 30~~claims 37 to 39~~, wherein the post-growth modification step is by exposure of the carbon-based layer to a gas plasma.

32~~41~~. The method of claim 31~~40~~, wherein the gas plasma is generated from hydrogen gas.

33~~42~~. The method of claim 31~~40~~ or claim 32~~41~~, wherein the gas plasma is generated by heating a gas.

34~~43~~. The method of any one of claims 21 to 33~~25 to 42~~, wherein the substrate is a metal.

35~~44~~. The method of claim 34~~43~~, wherein the metal is a transition metal.

36~~45~~. The method of claim 35~~44~~, wherein the transition metal is a second row or third row transition metal.

37~~46~~. The method of claim 36~~45~~, wherein the second row transition metal is molybdenum, or the third row transition metal is tungsten.