We claim: ~~1. A method of forming a microelectronic structure, said method comprising:~~

~~optionally forming one or more intermediate layers on a substrate surface, there being an uppermost intermediate layer on said substrate surface, if one or more intermediate layers are present;~~

~~applying a composition to said uppermost intermediate layer, if present, or to said substrate surface, if no intermediate layers are present, said composition comprising one or both of a diimide or a polyimide dissolved or dispersed in a solvent system; and~~

~~heating said composition to form a carbon-rich layer, said carbon-rich layer having the property of presenting fewer than about 0.1 defects/$cm^2$ of layer surface area if subjected to a CVD survivability test.~~

~~2. The method of claim 1, further comprising:~~

~~optionally forming one or more additional intermediate layers on said carbon rich layer, there being an uppermost additional intermediate layer on said substrate surface, if one or more additional intermediate layers are present;~~

~~applying an imaging layer to said one or more additional intermediate layers, if present, or to said carbon-rich layer, if no additional intermediate layers are present;~~

~~patterning said imaging layer to form a pattern therein;~~

~~transferring said pattern to said one or more additional intermediate layers on said carbon rich layer, if present, and to said carbon-rich layer; and~~

~~contacting said carbon-rich layer with SC1.~~

~~3. The method of claim 1, wherein said substrate surfaces comprises an intermediate layer, and said intermediate layer is chosen from TiN or $SiO_2$.~~

~~4. The method of claim 1, wherein said carbon-rich layer has the property of being SC1 resistant.~~

~~5. The method of claim 1, wherein said composition further comprises a component chosen from:~~

~~polyphenols;~~

~~polyhydroxy compounds;~~

phosphoric compounds; and

combinations of the foregoing.

6. The method of claim 1, wherein said solvent system comprises propylene glycol monomethyl ether, and said applying said composition is carried out without removing some or all of said propylene glycol monomethyl ether prior to said applying.

7. The method of claim 1, wherein said composition comprises a diimide formed from a diamic acid formed from:

(i) a dianhydride and a monoamine;

(ii) a monoanhydride and a diamine; or

(iii) both (i) and (ii).

8. The method of claim 7, wherein:

said dianhydride is chosen from benzophenone-3,3'4,4'-tetracarboxylic dianhydride, 4,4'-oxydiphthalic dianhydride, 9,9 bis(3,4 dicarboxyphenyl)fluorene dianhydride, and combinations thereof;

said monoamine is chosen from 2-vinylaniline, 4-vinylaniline, 2-allylaniline, 4-allylaniline, 3-ethynylaniline, 4 ethynylaniline, 2 ethynylaniline and combinations thereof;

said monoanhydride is chosen from maleic anhydride, 4-cyclohexene 1,2 dicarboxylic anhydride, 5 norbornene 2,3 dicarboxylic anhydride, 4 ethynyl phthalic anhydride, 4 methylethynyl phthalic anhydride, 4 phenylethynyl phthalic anhydride, and combinations thereof; and

said diamine is chosen from 4,4'-oxydianiline, bis(4-aminophenyl)sulfone, 9,9-bis(4-aminophenyl)fluorene, and combinations thereof.

9. A method of forming a microelectronic structure, said method comprising:

optionally forming one or more intermediate layers on a substrate surface, there being an uppermost intermediate layer on said substrate surface, if one or more intermediate layers are present;

applying a composition to said uppermost intermediate layer, if present, or to said substrate surface, if no intermediate layers are present, said composition comprising one or both of a diimide or a polyimide dissolved or dispersed in a solvent system;

heating said composition to form a carbon-rich layer;

optionally forming one or more additional intermediate layers on said carbon-rich layer, there being an uppermost additional intermediate layer on said substrate surface, if one or more additional intermediate layers are present;

applying an imaging layer to said one or more additional intermediate layers, if present, or to said carbon-rich layer, if no additional intermediate layers are present;

patterning said imaging layer to form a pattern therein;

transferring said pattern to said one or more additional intermediate layers on said carbon-rich layer, if present, and to said carbon-rich layer; and

contacting said carbon-rich layer with SC1.

10. The method of claim 9, wherein said substrate surfaces comprises an intermediate layer, and said intermediate layer is chosen from TiN or $SiO_2$.

11. The method of claim 9, wherein said carbon-rich layer has the property of being SC1 resistant.

12. The method of claim 9, wherein said composition further comprises a component chosen from:

polyphenols;

polyhydroxy compounds;

phosphoric compounds; and

combinations of the foregoing.

13. The method of claim 9, wherein said solvent system comprises propylene glycol monomethyl ether, and said applying said composition is carried out without removing some or all of said propylene glycol monomethyl ether prior to said applying.

14. The method of claim 9, wherein said composition comprises a diimide formed from a diamic acid formed from:

(i) a dianhydride and a monoamine;

(ii) a monoanhydride and a diamine; or

(iii) both (i) and (ii).

15. The method of claim 14, wherein:

said dianhydride is chosen from benzophenone-3,3'4,4'-tetracarboxylic dianhydride, 4,4'-oxydiphthalic dianhydride, 9,9 bis(3,4 dicarboxyphenyl)fluorene dianhydride, and combinations thereof;

said monoamine is chosen from 2 vinylaniline, 4 vinylaniline, 2 allylaniline, 4 allylaniline, 3-ethynylaniline, 4-ethynylaniline, 2-ethynylaniline and combinations thereof;

said monoanhydride is chosen from maleic anhydride, 4-cyclohexene-1,2-dicarboxylic anhydride, 5 norbornene 2,3 dicarboxylic anhydride, 4 ethynyl phthalic anhydride, 4 methylethynyl phthalic anhydride, 4 phenylethynyl phthalic anhydride, and combinations thereof; and

said diamine is chosen from 4,4'-oxydianiline, bis(4-aminophenyl)sulfone, 9,9-bis(4-aminophenyl)fluorene, and combinations thereof.

16. A method of forming a microelectronic structure, said method comprising:

optionally forming one or more intermediate layers on a substrate surface, there being an uppermost intermediate layer on said substrate surface, if one or more intermediate layers are present;

applying a composition to said uppermost intermediate layer, if present, or to said substrate surface, if no intermediate layers are present, said composition comprising one or both of a diimide or a polyimide dissolved or dispersed in a solvent system; and

heating said composition to form a carbon-rich layer having the property of SC1 resistance.

17. The method of claim 16, wherein said substrate surfaces comprises an intermediate layer, and said intermediate layer is chosen from TiN or $SiO_2$.

18. The method of claim 16, wherein said composition further comprises a component chosen from:

polyphenols;

polyhydroxy compounds;

phosphoric compounds; and

combinations of the foregoing.

19. The method of claim 16, wherein said solvent system comprises propylene glycol

~~monomethyl ether, and said applying said composition is carried out without removing some or all of said propylene glycol monomethyl ether prior to said applying.~~

~~20. The method of claim 16, wherein said composition comprises a diimide formed from a diamic acid formed from:~~

~~(i) a dianhydride and a monoamine;~~

~~(ii) a monoanhydride and a diamine; or~~

~~(iii) both (i) and (ii).~~

~~21. The method of claim 20, wherein:~~

~~said dianhydride is chosen from benzophenone-3,3'4,4'-tetracarboxylic dianhydride, 4,4'-oxydiphthalic dianhydride, 9,9 bis(3,4 dicarboxyphenyl)fluorene dianhydride, and combinations thereof;~~

~~said monoamine is chosen from 2 vinylaniline, 4 vinylaniline, 2 allylaniline, 4 allylaniline, 3 ethynylaniline, 4-ethynylaniline, 2-ethynylaniline and combinations thereof;~~

~~said monoanhydride is chosen from maleic anhydride, 4 cyclohexene 1,2 dicarboxylic anhydride, 5 norbornene 2,3 dicarboxylic anhydride, 4 ethynyl phthalic anhydride, 4 methylethynyl phthalic anhydride, 4 phenylethynyl phthalic anhydride, and combinations thereof; and~~

~~said diamine is chosen from 4,4' oxydianiline, bis(4 aminophenyl)sulfone, 9,9 bis(4 aminophenyl)fluorene, and combinations thereof.~~

1~~22~~. A method of forming a microelectronic structure, said method comprising:

optionally forming one or more intermediate layers on a substrate surface, there being an uppermost intermediate layer on said substrate surface, if one or more intermediate layers are present;

applying a composition to said uppermost intermediate layer, if present, or to said substrate surface, if no intermediate layers are present, said composition comprising one or both of a diimide or a polyimide and a component dissolved or dispersed in a solvent system, said component chosen from:

polyphenols comprising at least four phenol rings;

polyhydroxy compounds;

phosphoric compounds; and

combinations of the foregoing; and

heating said composition to form a carbon-rich layer.

2~~23~~. The method of claim 1~~22~~, wherein said substrate surface comprises an intermediate layer, and said intermediate layer is chosen from TiN or $SiO_2$.

3~~24~~. The method of claim 1~~22~~, wherein said solvent system comprises propylene glycol monomethyl ether, and said applying said composition is carried out without removing some or all of said propylene glycol monomethyl ether prior to said applying.

4~~25~~. The method of claim 1~~22~~, wherein said composition comprises a diimide formed from a diamic acid formed from:

(i) a dianhydride and a monoamine;

(ii) a monoanhydride and a diamine; or

(iii) both (i) and (ii).

5~~26~~. The method of claim 4~~25~~, wherein:

said dianhydride is chosen from benzophenone-3,3'4,4'-tetracarboxylic dianhydride, 4,4'-oxydiphthalic dianhydride, 9,9-bis(3,4-dicarboxyphenyl)fluorene dianhydride, and combinations thereof;

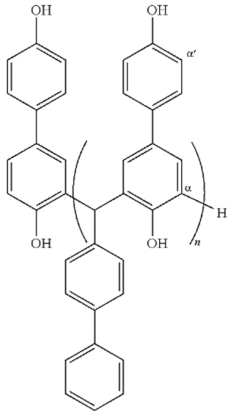
said monoamine is chosen from 2-vinylaniline, 4-vinylaniline, 2-allylaniline, 4-allylaniline, 3-ethynylaniline, 4-ethynylaniline, 2-ethynylaniline and combinations thereof;

said monoanhydride is chosen from maleic anhydride, 4-cyclohexene-1,2-dicarboxylic anhydride, 5-norbornene-2,3-dicarboxylic anhydride, 4-ethynyl phthalic anhydride, 4-methylethynyl phthalic anhydride, 4-phenylethynyl phthalic anhydride, and combinations thereof; and

said diamine is chosen from 4,4'-oxydianiline, bis(4-aminophenyl)sulfone, 9,9-bis(4-aminophenyl)fluorene, and combinations thereof.

6~~27~~. The method of claim 1~~22~~, wherein:

said polyphenol is




where n is 1 to 5 and the molecular chain may be bonded to carbon α' instead of, or in addition to, carbon α;

said polyhydroxy compound is chosen from gallic acid, methyl gallate, 4-hydroxybenzoic acid, pyrogallol, 2,3,4,3',4',5'-hexahydroxybenzophenone, boronated polystyrene, 3,3',5,5'-tetrakis(methoxymethyl)-[1,1'-biphenyl]-4,4'-diol, and poly(4-vinyl phenol), and combinations thereof; and

said phosphoric compound is chosen from phenylbis(2,4,6-trimethylbenzoyl)phosphine oxide, and dimethyl phenyl phosphonate, phenyl phosphate, phenyl phosphonic acid, phytic acid, and combinations thereof.

~~28. A method of forming a microelectronic structure, said method comprising:~~

~~imidizing one or both of a diamic acid or a polyamic acid in a solvent system comprising propylene glycol monomethyl ether so as to form a composition comprising one or both of a diimide or a polyimide;~~

~~optionally forming one or more intermediate layers on a substrate surface, there being an uppermost intermediate layer on said substrate surface, if one or more intermediate layers are present;~~

~~without removing some or all of said propylene glycol monomethyl ether, applying said composition to said uppermost intermediate layer, if present, or to said substrate surface, if no intermediate layers are present, said composition; and~~

~~heating said composition to form a carbon-rich layer.~~

~~29. The method of claim 28, further comprising:~~

optionally forming one or more additional intermediate layers on said carbon rich layer, there being an uppermost additional intermediate layer on said substrate surface, if one or more additional intermediate layers are present;

applying an imaging layer to said one or more additional intermediate layers, if present, or to said carbon rich layer, if no additional intermediate layers are present;

patterning said imaging layer to form a pattern therein;

transferring said pattern to said one or more additional intermediate layers on said carbon rich layer, if present, and to said carbon-rich layer; and

contacting said carbon rich layer with SC1.

30. The method of claim 28, wherein said substrate surfaces comprises an intermediate layer, and said intermediate layer is chosen from TiN or $SiO_2$.

31. The method of claim 28, wherein said composition comprises a diimide formed from a diamic acid formed from:

(i) a dianhydride and a monoamine;

(ii) a monoanhydride and a diamine; or

(iii) both (i) and (ii).

32. The method of claim 31, wherein:

said dianhydride is chosen from benzophenone 3,3'4,4' tetracarboxylic dianhydride, 4,4'-oxydiphthalic dianhydride, 9,9 bis(3,4 dicarboxyphenyl)fluorene dianhydride, and combinations thereof;

said monoamine is chosen from 2 vinylaniline, 4 vinylaniline, 2 allylaniline, 4 allylaniline, 3 ethynylaniline, 4 ethynylaniline, 2 ethynylaniline and combinations thereof;

said monoanhydride is chosen from maleic anhydride, 4-cyclohexene-1,2-dicarboxylic anhydride, 5 norbornene 2,3 dicarboxylic anhydride, 4 ethynyl phthalic anhydride, 4 methylethynyl phthalic anhydride, 4 phenylethynyl phthalic anhydride, and combinations thereof; and

said diamine is chosen from 4,4'-oxydianiline, bis(4-aminophenyl)sulfone, 9,9-bis(4-aminophenyl)fluorene, and combinations thereof.

~~33. A method of forming a microelectronic structure, said method comprising:~~

~~optionally forming one or more intermediate layers on a substrate surface, there being an uppermost intermediate layer on said substrate surface, if one or more intermediate layers are present;~~

~~applying a composition to said uppermost intermediate layer, if present, or to said substrate surface, if no intermediate layers are present, said composition comprising a polyimide dissolved or dispersed in a solvent system and having a weight average molecular weight of about 2,000 Daltons to about 7,000 Daltons; and~~

~~heating said composition to form a carbon-rich layer.~~

~~34. The method of claim 33, wherein said substrate surfaces comprises an intermediate layer, and said intermediate layer is chosen from TiN or $SiO_2$.~~

7~~35~~. A composition comprising:

a diimide;

a component chosen from:

polyphenols comprising at least four phenol rings;

polyhydroxy compounds;

phosphoric compounds; and

combinations of the foregoing; and

a solvent system.

8~~36~~. The composition of claim 7~~35~~, wherein said solvent system comprises propylene glycol monomethyl ether.

9~~37~~. The composition of claim 7~~35~~, wherein said composition comprises a diimide formed from a diamic acid formed from:

(i) a dianhydride and a monoamine;

(ii) a monoanhydride and a diamine; or

(iii) both (i) and (ii).

10~~38~~. The composition of claim 9~~37~~, wherein:

said dianhydride is chosen from benzophenone-3,3'4,4'-tetracarboxylic dianhydride, 4,4'-oxydiphthalic dianhydride, 9,9-bis(3,4-dicarboxyphenyl)fluorene dianhydride, and combinations thereof;

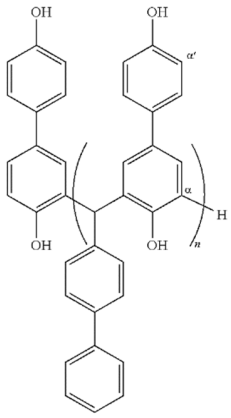
said monoamine is chosen from 2-vinylaniline, 4-vinylaniline, 2-allylaniline, 4-allylaniline, 3-ethynylaniline, 4-ethynylaniline, 2-ethynylaniline and combinations thereof;

said monoanhydride is chosen from maleic anhydride, 4-cyclohexene-1,2-dicarboxylic anhydride, 5-norbornene-2,3-dicarboxylic anhydride, 4-ethynyl phthalic anhydride, 4-methylethynyl phthalic anhydride, 4-phenylethynyl phthalic anhydride, and combinations thereof; and

said diamine is chosen from 4,4'-oxydianiline, bis(4-aminophenyl)sulfone, 9,9-bis(4-aminophenyl)fluorene, and combinations thereof.

11~~39~~. The composition of claim 7~~35~~, wherein:

said polyphenols are chosen from




where n is 1 to 5 and the molecular chain may be bonded to carbon α' instead of, or in addition to, carbon α;

said polyhydroxy compounds are chosen from gallic acid, methyl gallate, 4-hydroxybenzoic acid, pyrogallol, 2,3,4,3',4',5'-hexahydroxybenzophenone, boronated polystyrene, 3,3',5,5'-tetrakis(methoxymethyl)-[1,1'-biphenyl]-4,4'-diol, and poly(4-vinyl phenol), and combinations thereof; and

said phosphoric compounds are chosen from phenylbis(2,4,6-trimethylbenzoyl)phosphine oxide,

and dimethyl phenyl phosphonate, phenyl phosphate, phenyl phosphonic acid, phytic acid, and combinations thereof.

1240. A microelectronic structure comprising:

a microelectronic substrate having a surface;

optionally one or more intermediate layers on said substrate surface, there being an uppermost intermediate layer on said substrate surface, if one or more intermediate layers are present;

a layer of a composition on said uppermost intermediate layer, if present, or on said substrate surface, if no intermediate layers are present, said composition comprising:

one or both of a diimide or a polyimide;

a component chosen from:

polyphenols comprising at least four phenol rings;

polyhydroxy compounds;

phosphoric compounds; and

combinations of the foregoing; and

a solvent system.

1341. The structure of claim 1240, wherein said substrate surfaces comprises an intermediate layer, and said intermediate layer is chosen from TiN or $SiO_2$.

1442. The structure of claim 1240, wherein said solvent system comprises propylene glycol monomethyl ether.

1543. The structure claim 1240, wherein said composition comprises a diimide formed from a diamic acid formed from:

(i) a dianhydride and a monoamine;

(ii) a monoanhydride and a diamine; or

(iii) both (i) and (ii).

1644. The structure of claim 1543, wherein:

said dianhydride is chosen from benzophenone-3,3'4,4'-tetracarboxylic dianhydride, 4,4'-oxydiphthalic dianhydride, 9,9-bis(3,4-dicarboxyphenyl)fluorene dianhydride, and

combinations thereof;

said monoamine is chosen from 2-vinylaniline, 4-vinylaniline, 2-allylaniline, 4-allylaniline, 3-ethynylaniline, 4-ethynylaniline, 2-ethynylaniline and combinations thereof;

said monoanhydride is chosen from maleic anhydride, 4-cyclohexene-1,2-dicarboxylic anhydride, 5-norbornene-2,3-dicarboxylic anhydride, 4-ethynyl phthalic anhydride, 4-methylethynyl phthalic anhydride, 4-phenylethynyl phthalic anhydride, and combinations thereof; and

said diamine is chosen from 4,4'-oxydianiline, bis(4-aminophenyl)sulfone, 9,9-bis(4-aminophenyl)fluorene, and combinations thereof.

~~45. A microelectronic structure comprising:~~

~~a microelectronic substrate having a surface;~~

~~optionally one or more intermediate layers on said substrate surface, there being an uppermost intermediate layer on said substrate surface, if one or more intermediate layers are present;~~

~~a carbon rich layer on said uppermost intermediate layer, if present, or on said substrate surface, if no intermediate layers are present, said carbon rich layer comprising:~~

~~one or both of a crosslinked diimide or a crosslinked polyimide; and~~

~~a component chosen from:~~

- ~~polyphenols comprising at least four phenol rings;~~
- ~~polyhydroxy compounds;~~
- ~~phosphoric compounds; and~~
- ~~combinations of the foregoing.~~

~~46. The structure of claim 45, wherein said substrate surfaces comprises an intermediate layer, and said intermediate layer is chosen from TiN or $SiO_2$.~~

~~47. The structure of claim 45, wherein said composition comprises a crosslinked diimide formed from a diamic acid formed from:~~

~~(i) a dianhydride and a monoamine;~~

~~(ii) a monoanhydride and a diamine; or~~

~~(iii) both (i) and (ii).~~

48. The structure of claim 47, wherein:

said dianhydride is chosen from benzophenone-3,3'4,4'-tetracarboxylic dianhydride, 4,4'-oxydiphthalic dianhydride, 9,9 bis(3,4 dicarboxyphenyl)fluorene dianhydride, and combinations thereof;

said monoamine is chosen from 2 vinylaniline, 4 vinylaniline, 2 allylaniline, 4 allylaniline, 3 ethynylaniline, 4 ethynylaniline, 2 ethynylaniline and combinations thereof;

said monoanhydride is chosen from maleic anhydride, 4 cyclohexene 1,2 dicarboxylic anhydride, 5 norbornene 2,3 dicarboxylic anhydride, 4 ethynyl phthalic anhydride, 4 methylethynyl phthalic anhydride, 4 phenylethynyl phthalic anhydride, and combinations thereof; and

said diamine is chosen from 4,4' oxydianiline, bis(4 aminophenyl)sulfone, 9,9 bis(4 aminophenyl)fluorene, and combinations thereof.

49. The structure of claim 45, further comprising:

one or more additional intermediate layers on said carbon rich layer, there being an uppermost additional intermediate layer on said substrate surface, if one or more additional intermediate layers are present; and

an imaging layer on said one or more additional intermediate layers, if present, or on said carbon rich layer, if no additional intermediate layers are present.