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 a diimide and a component dissolved or dispersed in a solvent system,

wherein:

said diimide is 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); and

said component is chosen from:

polyphenols comprising at least four phenol rings;

polyhydroxy compounds;

phosphoric compounds; or

combinations of the foregoing; and

heating said composition to form a carbon-rich layer.

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

3. 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.

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

(i) a dianhydride and a crosslinkable monoamine;

(ii) a crosslinkable monoanhydride and a diamine; or

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

5. The method of claim 1, 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, or combinations thereof;

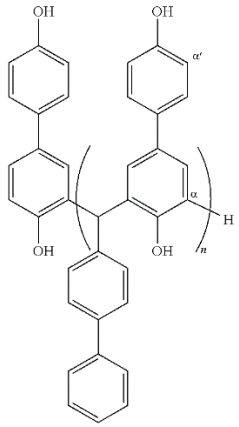
said monoamine is chosen from 2-vinylaniline, 4-vinylaniline, 2-allylaniline, 4-allylaniline, 3-ethynylaniline, 4-ethynylaniline, 2-ethynylaniline or combinations thereof;

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, or combinations thereof; and

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

6. The method of claim 1, 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, poly(4-vinyl phenol),

or 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, or combinations thereof.

7. A composition for forming a carbon-rich layer on a microelectronic substrate, the composition comprising:

a diimide that is 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);

a component chosen from:

polyphenols comprising at least four phenol rings;

polyhydroxy compounds;

phosphoric compounds; or

combinations of the foregoing; and

a solvent system.

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

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

(i) a dianhydride and a crosslinkable monoamine;

(ii) a crosslinkable monoanhydride and a diamine; or

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

10. The composition of claim 9, 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, or combinations thereof;

said monoamine is chosen from 2-vinylaniline, 4-vinylaniline, 2-allylaniline, 4-

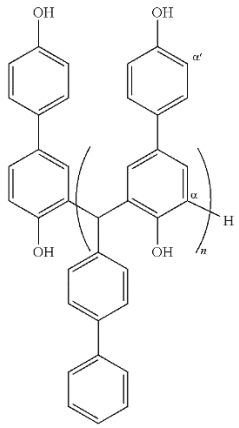
allylaniline, 3-ethynylaniline, 4-ethynylaniline, 2-ethynylaniline or combinations thereof;

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, or combinations thereof; and

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

11. The composition of claim 7, 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, poly(4-vinyl phenol), or 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, or combinations thereof.

12. 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:

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); and

a component chosen from:

polyphenols comprising at least four phenol rings;

polyhydroxy compounds;

phosphoric compounds; or

combinations of the foregoing; and

a solvent system.

13. The structure of claim 12, wherein said substrate surface comprises an intermediate layer, and said intermediate layer is chosen from TiN or $SiO_2$.

14. The structure of claim 12, wherein said solvent system comprises propylene glycol monomethyl ether.

15. The structure claim 12, wherein said composition comprises a diimide formed from a diamic acid formed from:

(i) a dianhydride and a crosslinkable monoamine;

(ii) a crosslinkable monoanhydride and a diamine; or

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

16. The structure of claim 12, 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, or combinations thereof;

said monoamine is chosen from 2-vinylaniline, 4-vinylaniline, 2-allylaniline, 4-

allylaniline, 3-ethynylaniline, 4-ethynylaniline, 2-ethynylaniline or 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, or combinations thereof; and

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