CLAIMS

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

forming an underlayer on a stack, said underlayer formed from a composition comprising a component chosen from:

(a) a polymer, an oligomer, or a mixture thereof comprising at least about 75 mol % of a monomer having an adhesion moiety and a surface modifying group chosen from a silanol moiety, an Si-O moiety, or both;

(b) a monomeric compound comprising an adhesion moiety and a surface modifying group chosen from a silanol moiety, an Si-O moiety, or both; or

(c) combinations of (a) and (b); and

forming a photoresist layer on said underlayer; and

subjecting at least a portion of said photoresist layer to EUV radiation.

2. The method of claim 1, wherein:

(i) said monomer further comprises an alkyl having first and second ends, said surface modifying group being at said first end and said adhesion moiety being at said second end;

(ii) said monomeric compound further comprises an alkyl having first and second ends, said surface modifying group being at said first end and said adhesion moiety being at said second end; or

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

3. The method of claim 1 or 2, wherein said adhesion moiety comprises one or more of an epoxy group, an isocyanurate group, a benzene group, a carbomethoxy group, a vinyl group, an anhydride group, a carboxylic acid group, a chlorine atom, or mixtures thereof.

4. The method of any of claims 1 to 3, wherein:

(I) said monomer comprises at least two surface modifying groups;

(II) said monomeric compound comprises at least two surface modifying groups; or

(III) both (I) and (II).

5. The method of any of claims 1 to 4, wherein:

(A) said monomer comprises a hydrolyzed form of glycidylpropyltrimethoxysilane, 2-(3,4-epoxycyclohexyl)ethyltriethoxysilane, 2-(3,4-epoxycyclohexyl)ethyltrimethoxysilane

phenyltrimethoxysilane, (1,3-di-2-propen-1-yl)-5-(([3-triethoxysilylpropyl])-(1,3,5-triazine-2,4,6 (1H,3H,5H)-trione), (methacryloxy-methyl)trimethoxysilane, 2-chloroethyltrimethoxysilane, 3-acetoxypropyltrimethoxysilane, 3-mercaptopropyltrimethoxysilane, 3-phenylpropyltrimethoxysilane, 4-amino-3,3-dimethylbutyltrimethoxysilane, vinyltrimethoxysilane, methyltrimethoxysilane, (3-triethoxysilyl)propyl]succinic anhydride, or combinations thereof;

(B) said monomeric compound comprises a hydrolyzed form of glycidylpropylmethyldiethoxysilane, 2-(3,4-epoxycyclohexyl)ethylmethyldiethoxysilane, phenyltrimethoxysilane, (1,3-di-2-propen-1-yl)-5-(([3-triethoxysilylpropyl])-(1,3,5-triazine-2,4,6 (1H,3H,5H)-trione), (methacryloxymethyl)methyl-dimethoxysilane, 2-chloroethylmethyldimethoxysilane, 3-acetoxypropylmethyldimethoxysilane, 3-mercaptopropylmethyldimethoxysilane, 3-phenylpropylmethyldimethoxysilane, 4-amino-3,3-dimethylbutylmethyldimethoxysilane, vinylmethyldimethoxysilane, dimethyl-dimethoxysilane, phenylmethyldimethoxysilane, or combinations thereof; or

(C) both (A) and (B).

6. The method of any of claims 1 to 5, wherein said polymer is a homopolymer, said oligomer is a homo-oligomer, or both.

7. The method of any of claims 1 to 6, wherein said underlayer has an average thickness of about 4.5 nm or less.

8. The method of any of claims 1 to 7, wherein said underlayer is a monolayer.

9. The method of any of claims 1 to 8, wherein said composition consists essentially of said component and a catalyst dispersed or dissolved in a solvent system.

10. The method of any of claims 1 to 8, wherein said composition consists essentially of said component, a catalyst, and a surfactant dispersed or dissolved in a solvent system.

11. The method of any of claims 1 to 10, wherein if said component is a polymer and if said monomer is 2-(3,4-epoxycyclohexyl)ethyltrimethoxysilane or a hydrolyzed form of 2-(3,4-epoxycyclohexyl)ethyltrimethoxysilane, at least one of the following is true:

said polymer has a weight-average molecular weight of less than about 2,000 Daltons;

said underlayer exhibits a % stripping of less than about 30%;

said polymer is crosslinked in said underlayer; or

said polymer is branched.

12. The method of any of claims 1 to 11, said stack comprising:

a substrate having a surface; and

optionally one or more intermediate layers on said surface, there being an uppermost intermediate layer on said surface, if one or more intermediate layers are present, said underlayer being on said uppermost intermediate layer, if present, or on said surface, if no intermediate layers are present.

13. The method of claim 12, further comprising:

forming a pattern in said photoresist layer after said subjecting said photoresist layer to EUV radiation; and

transferring said pattern:

to said underlayer;

to said intermediate layers, if present; and

to said substrate.

14. The method of claim 12 or 13, wherein said stack comprises said one or more intermediate layers on said surface, said one or more intermediate layers comprising a hardmask layer.

15. The method of any of claims 1 to 14, wherein said photoresist layer comprises a metal.

16. A structure comprising:

a 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;

an underlayer on said substrate surface, or on said uppermost intermediate layer, if present, said underlayer comprising:

(a) a polymer, an oligomer, or a mixture thereof comprising at least about 75 mol % of a monomer having an adhesion moiety at a first end of an alkyl and an Si-O moiety at a second end of said alkyl;

(b) a monomeric compound comprising an adhesion moiety at a first end of an alkyl and an Si-O moiety at a second end of said alkyl; or

(c) combinations of (a) and (b); and

a photoresist on said underlayer.

17. The structure of claim 16, wherein said photoresist is patternable at a wavelength of less than about 20 nm and/or at an exposure dose of about 5 mJ/cm^2 to about 100 mJ/cm^2.

18. The structure of claim 16 or 17, wherein said adhesion moiety comprises one or more of an epoxy group, an isocyanurate group, a benzene group, a carbomethoxy group, a vinyl group, an anhydride group, a carboxylic acid group, a chlorine atom, or mixtures thereof.

19. The structure of any of claims 16 to 18, wherein:

(I) said monomer comprises at least two Si-O moieties;

(II) said monomeric compound comprises at least two Si-O moieties; or

(III) both (I) and (II).

20. The structure of any of claims 16 to 19, wherein:

(A) said monomer comprises a hydrolyzed form of glycidylpropyltrimethoxysilane, 2-(3,4-epoxycyclohexyl)ethyltriethoxysilane, 2-(3,4-epoxycyclohexyl)ethyltrimethoxysilane phenyltrimethoxysilane, (1,3-di-2-propen-1-yl)-5-(([3-triethoxysilylpropyl])-(1,3,5-triazine-2,4,6 (1H,3H,5H)-trione), (methacryloxy-methyl)trimethoxysilane, 2-chloroethyltrimethoxysilane, 3-acetoxypropyltrimethoxysilane, 3-mercaptopropyltrimethoxysilane, 3-phenylpropyltrimethoxysilane, 4-amino-3,3-dimethylbutyltrimethoxysilane, vinyltrimethoxysilane, methyltrimethoxysilane, (3-triethoxysilyl)propyl]succinic anhydride, or combinations thereof;

(B) said monomeric compound comprises a hydrolyzed form of glycidylpropylmethyldiethoxysilane, 2-(3,4-epoxycyclohexyl)ethylmethyldiethoxysilane, phenyltrimethoxysilane, (1,3-di-2-propen-1-yl)-5-(([3-triethoxysilylpropyl])-(1,3,5-triazine-2,4,6 (1H,3H,5H)-trione), (methacryloxymethyl)methyl-dimethoxysilane, 2-

chloroethylmethyldimethoxysilane, 3-acetoxypropylmethyldimethoxysilane, 3-mercaptopropylmethyldimethoxysilane, 3-phenylpropylmethyldimethoxysilane, 4-amino-3,3-dimethylbutylmethyldimethoxysilane, vinylmethyldimethoxysilane, dimethyl-dimethoxysilane, phenylmethyldimethoxysilane, or combinations thereof; or

(C) both (A) and (B).

21. The structure of any of claims 16 to 20, wherein said polymer is a homopolymer, said oligomer is a homo-oligomer, or both.

22. The structure of any of claims 16 to 21, wherein said underlayer has an average thickness of about 4.5 nm or less.

23. The structure of any of claims 16 to 22, wherein said underlayer is a monolayer.

24. The structure of any of claims 16 to 23, wherein if said underlayer comprises said polymer and if said monomer is derived from a hydrolyzed form of 2-(3,4-epoxycyclohexyl)ethyltrimethoxysilane, at least one of the following is true:

said underlayer exhibits a % stripping of less than about 30%;

said polymer is crosslinked in said underlayer; or

said polymer is branched.

25. The structure of any of claims 16 to 24, wherein said stack comprises said one or more intermediate layers on said surface, said one or more intermediate layers comprising:

a spin-on carbon layer;

a hardmask layer; or

both said spin-on carbon layer and said hardmask layer on said spin-on carbon layer.

26. The structure of any of claims 16 to 25, wherein said photoresist layer comprises a metal.