~~We claim:~~ CLAIMS

1. A wafer bonding method comprising:

providing a stack comprising first and second substrates bonded together via a bonding layer formed from a bonding composition comprising:

a tackifier; and

a compound selected from the group consisting of rubbers, styrene-isoprene-styrene, styrene-butadiene-styrene, halogenated butyl rubber, and mixtures thereof,

said tackifier and said compound ~~a polymer~~ being dissolved or dispersed in a solvent system, said bonding composition comprising at least 30% by weight solvent system, based upon the total weight of the composition taken as 100% by weight;

subjecting said stack to a temperature of at least ~~about~~ 190°C so as to soften said bonding layer; and

applying a force to at least one of said first and second substrates while causing the other of said first and second substrates to resist said force, said force being applied in a sufficient amount so as to separate said first and second substrates.

2. The method of claim 1, said stack having an axis that passes through both the first and second substrates, said force being applied in a generally transverse direction relative to said axis.

3. The method of claim 1, said applying a force comprising lifting the at least one first and second substrate in a direction generally away from the other of said first and second substrates.

4. The method of claim 1, further comprising thinning one of said substrates prior to subjecting said stack to a temperature of at least ~~about~~ 190°C.

5. The method of claim 1, further comprising subjecting said stack to a process selected from the group consisting of backgrinding, metallizing, patterning, and combinations thereof prior to subjecting said stack to a temperature of at least ~~about~~ 190°C.

6. The method of claim 1, wherein said ~~polymer~~ compound is at least ~~about~~ 95% soluble in nonpolar solvents.

7. The method of claim 1, wherein said composition further comprises an ingredient selected from the group consisting of ~~tackifiers,~~ adhesion promoting agents, antioxidants, surfactants, and mixtures of the foregoing.

8. The method of claim 1, wherein said first substrate has a first surface and a second surface remote from said first surface and comprising at least one active site and plurality of topographical features, and said bonding layer is bonded to said second surface.

9. The method of claim 8, wherein said second substrate comprises a bonding surface that is bonded to said bonding layer.

10. The method of claim 9, wherein:

said topographical features present respective end surfaces remote from the first surface of said first substrate, and at least one of the end surfaces is further from the first surface of the first substrate than the other of said end surfaces, said further end surface defining a plane that is substantially parallel to said first surface; and

the distance from said plane to the bonding surface on said second substrate varying by less than ~~about~~ 10% across said plane and second substrate bonding surface.

11. The method of claim 1, wherein said first substrate:

has a first surface and a second surface remote from said first surface;

comprises at least one active site and plurality of topographical features on said second surface; and

is selected from the group consisting of microelectromechanical system devices, display devices, flexible substrates, compound semiconductors, low k dielectric layers, dielectric layers, ion implant layers, and substrates comprising silicon, aluminum, tungsten, tungsten silicide, gallium arsenide, germanium, tantalum, tantalum nitrite, SiGe, and mixtures of the foregoing.

12. The method of claim 1, wherein said second substrate comprises a carrier wafer comprising a material selected from the group consisting of sapphire, ceramic, glass, quartz, aluminum, silver, and silicon.

13. The method of claim 1, wherein said providing a stack comprises:

applying the bonding composition to one of the first and second substrates to form a bonding composition-coated substrate and a bonding composition-free substrate; and

contacting the bonding composition-free substrate with the bonding composition-coated substrate so as to bond the substrates together.

14. The method of claim 13, wherein said contacting comprises applying pressure to the substrates.

15. An article comprising:

a first substrate having a back surface and an active surface, said active surface comprising at least one active site and a plurality of topographical features;

a second substrate having a bonding surface; and

a thermoplastic bonding layer bonded to said active surface and to said bonding

surface, wherein:

said thermoplastic bonding layer is formed from a composition comprising a tackifier and a compound selected from the group consisting of rubbers, styrene-isoprene-styrene, styrene-butadiene-styrene, halogenated butyl rubber, and mixtures thereof,

said tackifier and said compound being dissolved or dispersed in a solvent system, said bonding composition comprising at least 30% by weight solvent system, based upon the total weight of the composition taken as 100% by weight;

said topographical features present respective end surfaces remote from the back surface of said first substrate, and at least one of the end surfaces is further from the back surface of the first substrate than the other of said end surfaces, said further end surface defining a plane that is substantially parallel to said first surface; and

the distance from said plane to the bonding surface on said second substrate varying by less than ~~about~~ 5% along said plane and second substrate bonding surface.

16. The article of claim 15, said bonding layer:

having a thickness defined as the distance from the active surface to the bonding surface; and

comprising the same composition across said thickness.

~~17. The article of claim 15, wherein said bonding layer is formed from a composition comprising a polymer dissolved or dispersed in a solvent system.~~

~~18~~17. The article of claim ~~17~~15, wherein said ~~polymer~~ compound is at least ~~about~~ 95% soluble in nonpolar solvents.

~~19~~18. The article of claim ~~17~~15, wherein said composition further comprises an ingredient selected from the group consisting of ~~tackifiers,~~ adhesion promoting agents, antioxidants, surfactants, and mixtures of the foregoing.

~~20~~19. The article of claim 15, wherein said first substrate is selected from the group consisting of microelectromechanical system devices, display devices, flexible substrates, compound semiconductors, low k dielectric layers, dielectric layers, ion implant layers, and substrates comprising silicon, aluminum, tungsten, tungsten silicide, gallium arsenide, germanium, tantalum, tantalum nitrite, SiGe, and mixtures of the foregoing.

~~21~~20. The article of claim 15, wherein said second substrate comprises a material selected from the group consisting of sapphire, ceramic, glass, quartz, aluminum, silver, and silicon.

~~22~~21. The article of claim 15, wherein said bonding layer has a softening temperature of at least ~~about~~ 190°C.

~~23~~22. A composition comprising a polymer and a poly(pinene) dissolved or dispersed in a solvent system, said polymer including recurring monomers comprising cyclo-olefins.

~~24~~23. The composition of claim ~~23~~22, wherein said composition comprises from ~~about~~ 5% to ~~about~~ 50% by weight of said polymer and from ~~about~~ 50% to ~~about~~ 95% of said pinene, based upon the total weight of the composition taken as 100% by weight.

~~25~~24. The composition of claim ~~24~~23, wherein said pinene is selected from the group consisting of α-pinene and β-pinene.

~~26~~25. The composition of claim ~~23~~22, wherein said solvent system comprises limonene, and said composition further comprising an adhesion promoting agent.

~~27~~26. A flowable, bonding composition comprising a tackifier and a polymer including recurring monomers comprising cyclo-olefins, said tackifier and polymer being dispersed or dissolved in a solvent system, said composition comprising at least ~~about~~ 30% by weight solvent system, based upon the total weight of the composition taken as 100% by weight.

~~28~~27. The composition of claim ~~27~~26, wherein said tackifier is a hydrocarbon resin.

~~29~~28. The composition of claim ~~27~~26, wherein said solvent system comprises a solvent selected from the group consisting of limonene, mesitylene, xylene, dodecene, propylene glycol monomethyl ether, methyl isoamyl ketone, ethyl acetoacetate, and mixtures thereof.

~~30~~29. The composition of claim ~~27~~26, wherein said composition further comprises an ingredient selected from the group consisting of antioxidants, surfactants, adhesion promoting agents, and mixtures thereof.

~~31~~30. The composition of claim ~~30~~29, wherein said ingredient comprises an antioxidant, and said antioxidant is selected from the group consisting of phenolic antioxidants and phosphite antioxidants.

~~32~~31. The composition of claim ~~27~~26, wherein said composition is essentially free of blowing and foaming agents.

~~33~~32. The composition of claim ~~27~~26, wherein said composition is essentially free of crosslinking agents.

~~34~~33. The composition of claim ~~27~~26, wherein said composition has a Mooney viscosity of less than ~~about~~ 35 MU.

~~35~~34. The composition of claim ~~27~~26, wherein said composition has a viscosity at 250°C of less than ~~about~~ 1,000 poise.

~~36~~35. A flowable, bonding composition comprising:

a tackifier; and

a compound selected from the group consisting of rubbers, styrene-isoprene-styrene, styrene-butadiene-styrene, halogenated butyl rubber, and mixtures thereof,

said tackifier and compound being dispersed or dissolved in a solvent system, said composition comprising at least ~~about~~ 30% by weight solvent system, based upon the total weight of the composition taken as 100% by weight.

~~37~~36. The composition of claim ~~36~~35, said composition further comprising a polymer including recurring monomers comprising cyclo-olefins.

~~38~~37. The composition of claim ~~36~~35, wherein said compound is a rubber selected from the group consisting of ethylene-propylene terpolymers, ethylene-propylene-diene monomers, and mixtures thereof.

~~39~~38. The composition of claim ~~36~~35, wherein said tackifier is a hydrocarbon resin.

~~40~~39. The composition of claim ~~36~~35, wherein said solvent system comprises a solvent selected from the group consisting of limonene, mesitylene, xylene, dodecene, propylene glycol monomethyl ether, methyl isoamyl ketone, ethyl acetoacetate, and mixtures thereof.

~~41~~40. The composition of claim ~~36~~35, wherein said composition further comprises an ingredient selected from the group consisting of antioxidants, surfactants, adhesion promoting agents, and mixtures thereof.

~~42~~41. The composition of claim ~~41~~40, wherein said ingredient comprises an antioxidant, and said antioxidant is selected from the group consisting of phenolic antioxidants and phosphite antioxidants.

~~43~~42. The composition of claim ~~36~~35, wherein said composition is essentially free of blowing and foaming agents.

~~44~~43. The composition of claim ~~36~~35, wherein said composition is essentially free of crosslinking agents.

~~45~~44. The composition of claim ~~36~~35, wherein said composition has a Mooney viscosity of less than ~~about~~ 35 MU.

~~46~~45. The composition of claim ~~36~~35, wherein said composition has a viscosity at 250°C of less than ~~about~~ 1,000 poise.

46. The wafer bonding method of claim 1, wherein said bonding composition further comprises a polymer including recurring monomers comprising cyclo-olefins.