We Claim:

1. A temporary bonding method including:

providing a stack comprising:

a first substrate having a back surface and a device surface;

a first bonding layer, adjacent to said device surface, having a softening temperature,

and wherein a first bonding layer thickness T_1 is no less than 24 μm;

a second bonding layer, adjacent to the first bonding layer, having a softening temperature, wherein the softening temperature of the first bonding layer is at least about 20°C greater than the softening temperature of the second bonding layer; and

a second substrate having a carrier surface, the second bonding layer being adjacent to the carrier surface; and

separating the first and second substrates.

2. The method of claim 1, wherein:

the second bonding layer has a thickness T_3 of less than 35 μm.

3. The method of claim 1, wherein:

the first bonding layer has a softening point of no less than 100°C.

4. The method of claim 1, wherein:

the second bonding layer has a softening point of less than 220°C.

5. The method of claim 1, wherein:

the first bonding layer is formed from a composition comprising a polymer or oligomer dissolved or dispersed in a solvent system, the polymer or oligomer being selected from a group consisting of polymers and oligomers of cyclic olefins, epoxies, acrylics, silicones, styrenics, vinyl halides, vinyl esters, polyamides, polyimides, polysulfones, polyethersulfones, cyclic olefins, polyolefin rubbers, and polyurethanes, ethylene-propylene rubbers, polyamide esters, polyimide esters, polyacetals, and polyvinyl buterols.

6. The method of claim 1, wherein:

the second bonding layer is formed from a composition comprising a polymer or oligomer dissolved or dispersed in a solvent system, the polymer or oligomer being selected from a group consisting of polymers and oligomers of cyclic olefins, epoxies, acrylics, silicones, styrenics, vinyl halides, vinyl esters, polyamides, polyimides, polysulfones, polyethersulfones, cyclic olefins, polyolefin rubbers, and polyurethanes, ethylene-propylene rubbers, polyamide esters, polyimide esters, polyacetals, and polyvinyl buterols.

7. The method of claim 1, wherein:

the device surface comprises an array of devices selected from a group consisting of integrated circuits; MEMS; microsensors; power semiconductors; light-emitting diodes; photonic circuits; interposers; embedded passive devices; and microdevices fabricated on or from silicon, silicon-germanium, gallium arsenide, and gallium nitride.

8. The method of claim 1, wherein:

the second substrate comprises a material selected from a group consisting of silicon, sapphire, quartz, metal, glass, and ceramics.

9. The method of claim 1, wherein:

the device surface comprises at least one structure selected from a group consisting of: solder bumps; metal posts; metal pillars; and structures formed from a material selected from the group consisting of silicon, polysilicon, silicon dioxide, silicon (oxy)nitride, metal, low k dielectrics, polymer dielectrics, metal nitrides, and metal silicides.

10. The method of claim 1, further including:

performing, on the stack, prior to separating the first and second substrates, processing selected from a group consisting of back-grinding, chemical-mechanical polishing, etching, metal and dielectric deposition, patterning, passivating, annealing, and combinations thereof.

11. The method of claim 1, wherein:

the separating includes heating the stack to a temperature sufficiently high so as to soften the second bonding layer sufficiently to enable separation of the first and second substrates.

12. The method of claim 11, further including:

removing the first bonding layer from the first substrate after the separating.

13. The method of claim 11, wherein:

at least several of the first bonding layer remains on the first substrate after the separating and is present during a subsequent processing step.

14. An article comprising:

a first substrate having a back surface and a device surface;

a first bonding layer, adjacent to said device surface, having a softening temperature, and wherein a first bonding layer thickness T_1 is no less than 24 μm;

a second bonding layer, adjacent to the first bonding layer, having a softening temperature, wherein the softening temperature of the first bonding layer is at least about 20°C greater than the softening temperature of the second bonding layer; and

a second substrate having a carrier surface, the second bonding layer being adjacent to the carrier surface.

15. The article of claim 14, wherein:

the second bonding layer has a thickness T_3 of less than 35 μm.

16. The article of claim 14, wherein:

the first bonding layer has a softening point of no less than 100°C.

17. The article of claim 14, wherein:

the second bonding layer has a softening point of less than 220°C.

18. The article of claim 14, wherein:

the first bonding layer is formed from a composition comprising a polymer or oligomer dissolved or dispersed in a solvent system, the polymer or oligomer being selected from the group consisting of polymers and oligomers of cyclic olefins, epoxies, acrylics, silicones, styrenics, vinyl halides, vinyl esters, polyamides, polyimides, polysulfones, polyethersulfones, cyclic olefins, polyolefin rubbers, and polyurethanes, ethylene-propylene rubbers, polyamide esters, polyimide esters, polyacetals, and polyvinyl buterols.

19. The article of claim 14, wherein:

the second bonding layer is formed from a composition comprising a polymer or oligomer dissolved or dispersed in a solvent system, the polymer or oligomer being selected from the group consisting of polymers and oligomers of cyclic olefins, epoxies, acrylics, silicones, styrenics, vinyl halides, vinyl esters, polyamides, polyimides, polysulfones, polyethersulfones, cyclic olefins, polyolefin rubbers, and polyurethanes, ethylene-propylene rubbers, polyamide esters, polyimide esters, polyacetals, and polyvinyl buterols.

20. The article of claim 14, wherein:

the device surface comprises an array of devices selected from a group consisting of integrated circuits; MEMS; microsensors; power semiconductors; light-emitting diodes; photonic circuits; interposers; embedded passive devices; and microdevices fabricated on or from silicon, silicon-germanium, gallium arsenide, and gallium nitride.

21. The article of claim 14, wherein:

the second substrate comprises a material selected from a group consisting of silicon, sapphire, quartz, metal, glass, and ceramics.

22. The article of claim 14, wherein:

the device surface comprises at least one structure selected from a group consisting of: solder bumps; metal posts; metal pillars; and structures formed from a material selected from the group consisting of silicon, polysilicon, silicon dioxide, silicon (oxy)nitride, metal, low k dielectrics, polymer dielectrics, metal nitrides, and metal silicides.