

CLAIMS

What is claimed is:

1) A method comprising:

providing a carrier substrate;
providing a cross-linking adhesive, the cross-linking adhesive being configured to outgas at a rate of less than approximately 2×10^{-4} Torr-liters per second;
providing a plastic substrate; and
coupling the carrier substrate to the plastic substrate using the cross-linking adhesive.

2) The method of claim 1 wherein:

coupling the carrier substrate to the plastic substrate comprises:
depositing the cross-linking adhesive over a first surface of the carrier substrate;
spinning the carrier substrate and the cross-linking adhesive to distribute the cross-linking adhesive over the first surface of the carrier substrate; and
placing a first surface of the plastic substrate over the first surface of the carrier substrate with the cross-linking adhesive located between the first surface of the plastic substrate and the first surface of the carrier substrate.

3) The method of claim 1 wherein:

coupling the carrier substrate to the plastic substrate comprises depositing the cross-linking adhesive over a first surface of the carrier substrate using at least one of the following techniques: spin-coating, spray-coating, extrusion coating, preform lamination, slot die coating, or screen lamination.

4) The method of claim 1 further comprising:

after coupling the carrier substrate to the plastic substrate, removing the plastic substrate from the carrier substrate.

5) The method of claim 1 further comprising:

after coupling the carrier substrate to the plastic substrate, fabricating one or more electrical components over a surface of the plastic substrate.

- 6) The method of claim 1 further comprising at least one of:
- thermally curing the cross-linking adhesive after coupling the carrier substrate to the plastic substrate;
 - curing the cross-linking adhesive with ultraviolet light after coupling the carrier substrate to the plastic substrate;
 - baking the plastic substrate before coupling the carrier substrate to the plastic substrate;
 - or
 - baking the cross-linking adhesive before coupling the carrier substrate to the plastic substrate.
- 7) The method of claim 1 further comprising:
- attaching a protective material to at least a first surface of the plastic substrate before coupling the carrier substrate to the plastic substrate, wherein coupling the carrier substrate to the plastic substrate comprises coupling the carrier substrate to a second surface of the plastic substrate using the cross-linking adhesive.
- 8) The method of claim 7, further comprising:
- providing a protective template; and
 - coupling the protective template to the plastic substrate,
- wherein:
- the protective material is at least partially located between the protective template and the plastic substrate.
- 9) The method of claim 8 further comprising:
- providing a shield material between the protective template and the protective material,
- 10) The method of claim 9 further comprising:
- laminating the carrier substrate, the cross-linking adhesive, the plastic substrate, the protective template, the protective material, and the shield material.

11) The method of claim 1 wherein at least one of:

providing the carrier substrate comprises providing the carrier substrate with at least a polished first surface;

providing the carrier substrate comprises providing the carrier substrate comprising at least one of alumina, silicon, stainless steel, or sapphire;

providing the carrier substrate comprises providing the carrier substrate comprising a material that is coefficient of thermal expansion matched to the plastic substrate;

providing the plastic substrate comprises providing the plastic substrate comprising of at least one of polyethylene naphthalate, polyethylene terephthalate, polyethersulfone, polyimide, polycarbonate, cyclic olefin copolymer, or liquid crystal polymer;

providing the plastic substrate comprises providing the plastic substrate with an elastic modulus of less than approximately five GigaPascals;

or

providing the plastic substrate comprises providing the plastic substrate with a thickness in the range of approximately 100 micrometers to approximately 200 micrometers.

12) The method of claim 1 wherein:

providing the cross-linking adhesive comprises providing a cross-linking acrylic adhesive.

13) The method of claim 1 wherein:

providing the cross-linking adhesive comprises providing the cross-linking adhesive having a thickness of approximately five micrometers to approximately fifteen micrometers.

14) A flexible substrate assembly comprising:

a carrier substrate with a first surface;

a cross-linking adhesive, the cross-linking adhesive being configured to outgas at a rate of less than approximately 2×10^{-4} Torr-liters per second; and

a plastic substrate having a first surface and a second surface opposite the first surface, wherein:

the first surface of the carrier substrate is coupled to the first surface of the plastic substrate with the cross-linking adhesive.

- 15) The flexible substrate assembly of claim 14 wherein at least one of:
- the carrier substrate comprises a polished surface opposite the first surface of the carrier substrate;
 - the carrier substrate comprising at least one of alumina, silicon, stainless steel, or sapphire;
 - the carrier substrate is coefficient of thermal expansion matched to the plastic substrate;
 - the plastic substrate comprises at least one of polyethylene naphthalate, polyethylene terephthalate, polyethersulfone, polyimide, polycarbonate, cyclic olefin copolymer, or liquid crystal polymer;
 - the plastic substrate comprises an elastic modulus of less than approximately five GigaPascals;
 - or
 - the plastic substrate comprises a thickness in the range of approximately 100 micrometers to approximately 200 micrometers.
- 16) The flexible substrate assembly of claim 14 further comprising:
- at least one of the following are located at the second surface of the plastic substrate:
 - one or more thin film transistors, organic light emitting diodes, inorganic light emitting diodes, electrode arrays, field effect transistors, or passive structures.
- 17) The flexible substrate assembly of claim 14 wherein:
- a thickness of the cross-linking adhesive between the carrier substrate and the plastic substrate is in the range of approximately five micrometers to approximately fifteen micrometers.
- 18) The flexible substrate assembly of claim 14 further comprising:
- a protective material over the second surface of the plastic substrate;
 - a protective template over the protective material; and
 - a shield material between the protective material and the protective template.
- 19) A method comprising:
- providing a carrier substrate;
 - providing a cross-linking adhesive, the cross-linking adhesive being configured to outgas at a rate of less than approximately 2×10^{-4} Torr-liters per second;

providing a plastic substrate; and

coupling the carrier substrate to the plastic substrate using the cross-linking adhesive, wherein coupling the carrier substrate to the plastic substrate using the cross-linking adhesive comprises:

spin-coating the cross-linking acrylic adhesive across a first surface of the carrier substrate such that a thickness of the cross-linking adhesive is in the range of approximately five micrometers to approximately fifteen micrometers;

using the cross-linking acrylic adhesive to couple the first surface of the carrier substrate to a first surface of the plastic substrate; and

laminating the carrier substrate and the plastic substrate with the cross-linking acrylic adhesive located between the support substrate and the plastic substrate.

20) The method of claim 19 further comprising:

after coupling the carrier substrate to the plastic substrate, fabricating one or more electrical components over a second surface of the plastic substrate.

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- 1) A method comprising:
 - providing a carrier substrate;
 - providing a cross-linking adhesive, the cross-linking adhesive being configured to outgas at a rate of less than approximately 2×10^{-4} Torr-liters per second;
 - providing a plastic substrate;
 - coupling the carrier substrate to the plastic substrate using the cross-linking adhesive; and
 - after coupling the carrier substrate to the plastic substrate, fabricating one or more electrical components over a surface of the plastic substrate while the carrier substrate remains coupled to the plastic substrate.
- 2) The method of claim 1 wherein:
 - coupling the carrier substrate to the plastic substrate comprises:
 - depositing the cross-linking adhesive over a first surface of the carrier substrate;
 - spinning the carrier substrate and the cross-linking adhesive to distribute the crosslinking adhesive over the first surface of the carrier substrate; and
 - placing a first surface of the plastic substrate over the first surface of the carrier substrate with the cross-linking adhesive located between the first surface of the plastic substrate and the first surface of the carrier substrate.
- 3) The method of claim 1 wherein:
 - coupling the carrier substrate to the plastic substrate comprises depositing the cross-linking adhesive over a first surface of the carrier substrate using at least one of: spin-coating, spray-coating, extrusion coating, preform lamination, slot die coating, or screen lamination.

- 4) The method of claim 1 further comprising:
after coupling the carrier substrate to the plastic substrate, removing the plastic substrate from the carrier substrate.
- 5) The method of claim 1 wherein:
providing the carrier substrate comprises providing the carrier substrate comprising a material that is CTE matched to the plastic substrate.
- 6) The method of claim 1 further comprising at least one of:
thermally curing the cross-linking adhesive after coupling the carrier substrate to the plastic substrate;
curing the cross-linking adhesive with ultraviolet light after coupling the carrier substrate to the plastic substrate;
baking the plastic substrate before coupling the carrier substrate to the plastic substrate; or
baking the cross-linking adhesive before coupling the carrier substrate to the plastic substrate.
- 7) The method of claim 1 further comprising:
attaching a protective material to at least a first surface of the plastic substrate before coupling the carrier substrate to the plastic substrate, wherein coupling the carrier substrate to the plastic substrate comprises coupling the carrier substrate to a second surface of the plastic substrate using the cross-linking adhesive.
- 8) The method of claim 7, further comprising:
providing a protective template; and
coupling the protective template to the plastic substrate,
wherein:
the protective material is at least partially located between the protective template and the plastic substrate.

- 9) The method of claim 8 further comprising:
providing a shield material between the protective template and the protective material.
- 10) The method of claim 9 further comprising:
laminating the carrier substrate, the cross-linking adhesive, the plastic substrate, the protective template, the protective material, and the shield material.
- 11) The method of claim 1 wherein at least one of:
providing the carrier substrate comprises providing the carrier substrate with at least a polished first surface;
providing the carrier substrate comprises providing the carrier substrate comprising at least one of alumina, silicon, stainless steel, or sapphire;
providing the plastic substrate comprises providing the plastic substrate comprising of at least one of polyethylene naphthalate, polyethylene terephthalate, polyethersulfone, polyimide, polycarbonate, cyclic olefin copolymer, or liquid crystal polymer;
providing the plastic substrate comprises providing the plastic substrate with an elastic modulus of less than approximately five GigaPascals;
or
providing the plastic substrate comprises providing the plastic substrate with a thickness in a range of approximately 100 micrometers to approximately 200 micrometers.
- 12) The method of claim 1 wherein:
providing the cross-linking adhesive comprises providing a cross-linking acrylic adhesive.
- 13) The method of claim 1 wherein:
providing the cross-linking adhesive comprises providing the cross-linking adhesive such that a thickness of the cross-linking adhesive between the carrier

substrate and the plastic substrate is in a range of approximately five micrometers to approximately fifteen micrometers.

- 14) A flexible substrate assembly comprising:
- a carrier substrate with a first surface;
 - a cross-linking adhesive, the cross-linking adhesive being configured to outgas at a rate of less than approximately 2×10^{-4} Torr-liters per second;
 - a plastic substrate having a first surface and a second surface opposite the first surface; and
 - one or more electrical components located over the second surface of the plastic substrate;
- wherein:
- the first surface of the carrier substrate is coupled to the first surface of the plastic substrate with the cross-linking adhesive.
- 15) The flexible substrate assembly of claim 14 wherein at least one of:
- the carrier substrate comprises a polished surface opposite the first surface of the carrier substrate;
 - the carrier substrate comprising at least one of alumina, silicon, stainless steel, or sapphire;
 - the carrier substrate is CTE matched to the plastic substrate;
 - the plastic substrate comprises at least one of polyethylene naphthalate, polyethylene terephthalate, polyethersulfone, polyimide, polycarbonate, cyclic olefin copolymer, or liquid crystal polymer;
 - the plastic substrate comprises an elastic modulus of less than approximately five GigaPascals;
 - or
 - the plastic substrate comprises a thickness in a range of approximately 100 micrometers to approximately 200 micrometers.
- 16) The flexible substrate assembly of claim 14 wherein:

the one or more electrical components comprise at least one of: one or more thin film transistors, one or more organic light emitting diodes, one or more inorganic light emitting diodes, one or more electrode arrays, one or more field effect transistors, or one or more passive structures.

- 17) The flexible substrate assembly of claim 14 wherein:
 - a thickness of the cross-linking adhesive between the carrier substrate and the plastic substrate is in a range of approximately five micrometers to approximately fifteen micrometers.
- 18) The flexible substrate assembly of claim 14 further comprising:
 - a protective material over the second surface of the plastic substrate;
 - a protective template over the protective material; and
 - a shield material between the protective material and the protective template.
- 19) A method comprising:
 - providing a carrier substrate;
 - providing a cross-linking acrylic adhesive, the cross-linking acrylic adhesive being configured to outgas at a rate of less than approximately 2×10^{-4} Torr-liters per second;
 - providing a plastic substrate;
 - coupling the carrier substrate to the plastic substrate using the cross-linking acrylic adhesive, wherein coupling the carrier substrate to the plastic substrate using the cross-linking acrylic adhesive comprises:
 - spin-coating the cross-linking acrylic adhesive across a first surface of the carrier substrate such that a thickness of the cross-linking acrylic adhesive is in a range of approximately five micrometers to approximately fifteen micrometers;
 - using the cross-linking acrylic adhesive to couple the first surface of the carrier substrate to a first surface of the plastic substrate; and
 - laminating the carrier substrate and the plastic substrate with the cross-linking acrylic adhesive located between the carrier substrate and the plastic substrate; and

after coupling the carrier substrate to the plastic substrate, fabricating one or more electrical components over a second surface of the plastic substrate while the carrier substrate remains coupled to the plastic substrate.

20) The method of claim 19 further comprising:

providing the carrier substrate comprises providing the carrier substrate comprising a material that is CTE matched to the plastic substrate.