processing, wet processing, and/or ultrasonic cleaning processing), together with covalent bonding regions to provide for further processing options, for example, maintaining hermeticity between the carrier and sheet even after dicing the article into smaller pieces for additional device processing. Still further, some surface modification layers provide control of the bonding between the carrier and sheet while, at the same time, reduce outgassing emissions during the harsh conditions in an FPD (for example LTPS) processing environment, including high temperature and/or vacuum processing, for example.

[0013a] In one aspect, the present disclosure relates to a method of annealing glass, comprising stacking a plurality of glass layers, each of the glass layers having two major surfaces, so that interfaces are defined between adjacent ones of the glass layers in the plurality of glass layers, wherein there is disposed on at least one of the major surfaces that faces one of the interfaces, a surface modification layer; exposing the stack of glass layers to a time-temperature cycle sufficient to compact each of the glass layers, wherein the surface modification layer is sufficient to control, throughout the time-temperature cycle, bonding between the adjacent ones of the glass layers in the stack defining the one of the interfaces, wherein bonding is controlled to be of such a force so that one layer does not separate from another if one is held and the other subjected to the force of gravity, but so that the layers may be separated without breaking one of the adjacent ones of the glass layers into two or more pieces, wherein the surface modification layer is one of HMDS, a plasma polymerized fluoropolymer, and an aromatic silane, and wherein the surface modification layer comprises a plasma polymerized fluoropolymer, and is one of: plasma polymerized polytetrafluroethylene; and a plasma polymerized fluoropolymer surface modification layer deposited from a CF4-C4F8 mixture having $\leq 40\%$ C4F8.

[0014] Additional features and advantages will be set forth in the detailed description which follows, and in part will be readily apparent to those skilled in the art from the description or recognized by practicing the various examples as exemplified in the written description and the appended drawings. It is to be understood that both the foregoing general description and the following detailed description are merely exemplary of the various examples, and are intended to provide an overview or framework to understanding the nature and character of the disclosure as it is claimed.

[0015] The accompanying drawings are included to provide a further understanding of principles of the disclosure, and are incorporated in and constitute a part of this specification. The drawings illustrate one or more example(s), and together with the description serve to

explain, by way of example, principles and operation of the disclosure. It is to be understood that various features disclosed in this specification and in the drawings can be used in any and all combinations. By way of non-limiting example the various features may be combined with one another as set forth in the appended claims

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 is a schematic side view of an article having carrier bonded to a thin sheet with a surface modification layer therebetween.

[0017] FIG. 2 is an exploded and partially cut-away view of the article in FIG. 1.

[0018] FIG. 3 is a graph of surface hydroxyl concentration on silica as a function of temperature.

[0019] FIG. 4 is a graph of the surface energy of an SC1-cleaned sheet of glass as a function annealing temperature.

[0020] FIG. 5 is a graph of the surface energy of a thin fluoropolymer film deposited on a sheet of glass as a function of the percentage of one of the constituent materials from which the film was made.

[0021] FIG. 6 is a schematic top view of a thin sheet bonded to a carrier by bonding areas.

[0022] FIG. 7 is a schematic side view of a stack of glass sheets

What is Claimed is:

1. A method of annealing glass, comprising:

stacking a plurality of glass layers, each of the glass layers having two major surfaces, so that interfaces are defined between adjacent ones of the glass layers in the plurality of glass layers, wherein there is disposed on at least one of the major surfaces that faces one of the interfaces, a surface modification layer;

exposing the stack of glass layers to a time-temperature cycle sufficient to compact each of the glass layers,

wherein the surface modification layer is sufficient to control, throughout the time-temperature cycle, bonding between the adjacent ones of the glass layers in the stack defining the one of the interfaces, wherein bonding is controlled to be of such a force so that one layer does not separate from another if one is held and the other subjected to the force of gravity, but so that the layers may be separated without breaking one of the adjacent ones of the glass layers into two or more pieces,

wherein the surface modification layer is one of HMDS, a plasma polymerized fluoropolymer, and an aromatic silane, and

wherein the surface modification layer comprises a plasma polymerized fluoropolymer, and is one of: plasma polymerized polytetrafluroethylene; and a plasma polymerized fluoropolymer surface modification layer deposited from a CF4-C4F8 mixture having ≤ 40% C4F8.

2. The method of claim 1, wherein the time-temperature cycle includes a temperature ≥ 400˚C, but less than the strain point of the glass.

3. The method of claim 1, wherein the time-temperature cycle includes a temperature ≥ 600˚C, but less than the strain point of the glass.

4. The method of claim 1, wherein the surface modification layer comprises an aromatic silane, and is a phenyl silane.

5. The method of claim 1, wherein the surface modification layer comprises an aromatic silane, and is one of: phenyltriethoxysilane; diphenyldiethoxysilane; and 4-pentafluorophenyltriethoxysilane.

6. The method of any one of claims 1-5, wherein the time-temperature cycle is carried out in an oxygen-free environment.

7. The method of any one of claim 1-6, wherein the stack of glass layers comprises a rolled sheet of glass.