apertures are made into the substrate. Apertures are also made in the display tape as it advances through the web process apparatus. The apertures serve, in one sense, to align the substrate and the display tape. Apertures can also be made in the display tape to allow blocks to couple with the display tape. The final display that is produced from this operation of combining the substrate and the display tape may be organic light-emitting diode, upconverting phosphorus, downconverting phosphorus, electrophoretic liquid crystal, polymer-dispersed liquid crystal, or cholesteric liquid crystal.

[0026] Another aspect of the invention relates to an operation that occurs after the FSA has been performed. In order to verify that the FSA process results in complete circuit element block placements, a "pick and place" process is utilized. This allows the blocks to be placed into an empty recessed region onto the substrate that was missed during FSA process. "Pick and place" may occur on a rigid substrate or on a web process material. The substrate is first checked for empty recessed regions. This is done by using an electronic eye viewing the substrate for empty recessed regions. Once an empty recessed region is detected, a robot is used to "pick and place" an object into an empty recessed region of the substrate.

[0027] Another aspect of the invention relates to web processing wherein display material (e.g., display material that provides a display mechanism such as an upconverting phosphorus) is deposited or patterned through an in-line process during the fabrication of displays. This method involves a flexible substrate wherein display material is placed onto the flexible substrate. This process is repeated for each display that is manufactured. The flexible substrate, which may be considered a display tape, is then coupled to a backplane that is on a separate substrate.

[0028] In one embodiment, the substrate has apertures that are added through a laser, punch press, template, or other operation. While the substrate is advanced through the in-line process, the FSA process is applied to the substrate. This allows the blocks to drop into the plurality of recessed regions in the substrate. The substrate is then advanced to the next operation wherein an interconnect is deposited. The substrate is then coupled to the display tape (either separating the sections of displays or before separating the displays from the tape).

[0029] While an array of components (e.g., display components) for an assembly have been described as examples of the invention, an array of other assemblies such as x-ray detectors, radar detectors, micro-electro-mechanical structural elements (MEMS) or, generally, an assembly of sensors or actuators or an assembly of circuit elements also may be produced using the claimed invention. Thus, for example, flexible antennas, other sensors, detectors, or an array of circuit elements may be fabricated using one of the embodiments of the inventions. Other aspects and methods of the present invention as well as apparatuses formed using these methods are described further below in conjunction with the following figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] The present invention is illustrated by way of example. The invention is not limited to the figures of the accompanying drawings in which like references indicate similar elements.

[0031] **FIG. 1A** shows a planar side view of an active matrix display backplane coupled to a rigid substrate.

[0032] **FIG. 1B** shows a planar side view of an active matrix display backplane coupled to a rigid substrate wherein a plurality of blocks are part of the active matrix display.

[0033] **FIG. 1C** shows a planar side view of a reflective display backplane coupled to a rigid substrate.

[0034] **FIG. 1D** shows a planar side view of a reflective display backplane coupled to a rigid substrate wherein a plurality of blocks are coupled to the reflective display and to the rigid substrate.

[0035] **FIG. 2** shows a top perspective view of a circuit element block.

[0036] **FIG. 3** shows a planar side view of blocks in recessed regions of the rigid substrate and a metalization surface on the blocks.

[0037] **FIG. 4** shows a planar side view of a rigid substrate coupled to a rigid display backplane with a plurality of blocks between the display backplane and substrate.

[0038] **FIG. 5** schematically represents a portion of an array of an active matrix backplane.

[0039] **FIG. 6** shows a top view of a plurality of pixel electrodes in a backplane.

[0040] **FIG. 7A** shows a planar side view of a flexible display device wherein an active matrix display backplane is coupled to a flexible substrate.

[0041] **FIG. 7B** shows a planar side view of a flexible display device wherein an active matrix display backplane is formed on a flexible substrate wherein a plurality of blocks are formed on the flexible substrate and flexible interconnect layers and pixel electrodes are deposited onto the flexible substrate.

[0042] **FIG. 7C** shows a top view of a flexible display device comprising an active matrix display backplane coupled to a flexible substrate wherein the flexible display device is coupled to an object.

[0043] **FIG. 8A** shows a top view of an active matrix display backplane.

[0044] **FIG. 8B** shows the top view of a passive matrix display backplane

[0045] **FIG. 8C** shows the top layer of a passive matrix display backplane.

[0046] **FIG. 8D** shows a bottom layer of a passive matrix display backplane.

[0047] **FIG. 9** shows a flow chart of the method of assembling a flexible display along the length of a flexible substrate.

[0048] **FIG. 10** shows a flow chart of the method of manufacturing multiple flexible displays along a flexible substrate.

[0049] **FIG. 11** shows a top view of a flexible substrate with multiple display components fabricated thereon.

[0050] **FIG. 12A** shows a top view of a display component that has a passive matrix display backplane attached thereto.