CLAIMS

1. An apparatus comprising:

a laser, the laser being operable as a pulsed laser to cut a sheet;

a clamp, the clamp being displaceable relative to a working zone of the apparatus;

a workpiece positioner, the workpiece positioner being configured to support a workpiece in the working zone with the workpiece,

wherein in a bonding stage, the clamp and the workpiece positioner are operable to cooperatively push the sheet and the workpiece toward one another, a selective bonding of the sheet with the workpiece being formed in the bonding stage,

and wherein in a cutting stage, the clamp is displaceable away relative to the working zone to enable the laser to cut the sheet along a perimeter of the selective bonding.

2. The apparatus as recited in claim 1, the apparatus comprising

a sheet feeder, the sheet feeder being operable to feed a sheet along a first axis to dispose the sheet in parallel to a reference plane in the working zone,

wherein the workpiece positioner is displaceable along a second axis to push a first surface of a workpiece against the sheet in the working zone, the second axis being normal to the reference plane;

wherein the clamp and the workpiece positioner are configured to cooperatively flatten the sheet between the clamp and the first surface of the workpiece, the clamp defining at least one continuous scan path in the reference plane, and

wherein the laser is configurable to irradiate the sheet along the scan path, wherein the laser is as a pulsed laser alternately operable to join the sheet with the workpiece and to cut through the sheet.

3. The apparatus as recited in claim 2, wherein the laser is operable to form a first joint between the sheet and the workpiece, and wherein the first joint comprises at least one continuous welded length parallel to the reference plane.

4. The apparatus as recited in claim 2 or claim 3, wherein the sheet feeder comprises a first drum roller and a second drum roller, the first drum roller and the second drum roller being configured to rotate in a same direction, and wherein the sheet is a continuous sheet provided by the second drum roller and collected by the first drum roller.

5. The apparatus as recited in any one of claims 2 to 4, wherein the workpiece positioner comprises a base plate coupled with a compressive force sensor, and wherein, in response to a feedback from the compressive force sensor, the base plate is controllably pushed towards the reference plane to cooperatively clamp the workpiece and the sheet together.

6. The apparatus as recited in any one of claims 2 to 5, wherein the workpiece positioner comprises positioning rollers coupled with a shear force sensor, the positioning rollers being disposed to engage opposing sides of the workpiece, and wherein, in response to a feedback from the shear force sensor, the positioning rollers are controllably rotated to displace the workpiece away from the reference plane.

7. The apparatus as recited in any one of claims 2 to 6, wherein the clamp comprises two clamp members, the two clamp members being spaced apart to define the elongated opening, and wherein at least one of the two clamp members is displaceable along a direction of scanning of the laser, at least one of the two clamp members being displaceable along the first axis, and wherein one of the two clamp members is displaceable away from another of the two clamp members.

8. The apparatus as recited in any one of claims 1 to 7, characterized in that the clamp is configured to be displaceable during the bonding stage.

9 . The apparatus as recited in claim 1,

wherein the workpiece positioner is displaceable along a second axis to push a first surface of the workpiece against the sheet, the second axis being normal to the reference plane;

wherein the clamp and the workpiece positioner are configured to cooperatively flatten the sheet between the clamp and the first surface of the workpiece, and

wherein the laser is configurable to cut the sheet along at least one scan path, the at least one scan path being defined by the clamp to be at least one continuous path, and wherein optionally the apparatus further comprises a radiator configured to pre-heat the sheet prior to the bonding stage.

10. The apparatus as recited in claim 9, wherein the clamp and the workpiece positioner are configured to provide a relative motion between the sheet and the workpiece,

and wherein the selective bonding includes one of a friction welded joint and an adhesive joint; and

the apparatus further including a sheet feeder, the sheet feeder being operable to feed the sheet along a feed direction to dispose the sheet in the working zone.

11 . A method comprising:

in a bonding stage, cooperatively pushing a sheet and a first surface of a workpiece together between a clamp and a workpiece positioner simultaneously with a forming of a selective bonding of the sheet with the workpiece;

displacing the clamp away relative to the working zone; and

in a cutting stage, laser cutting along a perimeter of the selective bonding.

12. The method as recited in claim 11, further comprising:

disposing the sheet in a reference plane in the working zone; and

displacing the workpiece along a second axis to abut the first surface of the workpiece against the sheet in the working zone, the second axis being normal to the reference plane;

feeding the sheet along a first axis to dispose the sheet in a working zone, wherein the first axis is parallel to the reference plane;

cooperatively flattening the sheet between the clamp and the first surface of the workpiece;

joining the sheet to the first surface of the workpiece by using a laser to irradiate the sheet along a scan path defined by the clamp,

wherein the laser is a pulsed laser alternately operable to join the sheet with the workpiece and to cut through the sheet,

wherein the laser is operable to form a first joint between the sheet and the workpiece,

and wherein the first joint comprises at least one continuous welded length parallel to the reference plane,

and wherein the workpiece is pushed towards the reference plane to cooperatively clamp the workpiece and the sheet together,

and wherein the workpiece is controllably displaced along a second axis towards the reference plane in response to a feedback from a compressive force sensor.

13 . The method as recited in claim 12, wherein the workpiece is displaceable away from the reference plane by positioning rollers,

and wherein the positioning rollers are disposed to engage opposing sides of the workpiece,

wherein workpiece is controllably displaced away from the reference plane by rotating the positioning rollers in response to a feedback from a shear force sensor.

14 . The method as recited in claim 12 or claim 13, further comprising:

welding a selected area of the sheet of a first material to the first surface of the workpiece;

cutting along an outer perimeter of the selected area to form an isolated pattern; and

further performing one of

(i) cutting along an inner perimeter of the selected area to form a cavity surrounded by the selected area; and

(ii) cutting a sheet of a second material to form a connected pattern, the connected pattern including a cavity complementary to the selected area, wherein the connected pattern is then mated with the isolated pattern, and wherein an interface between the first material and the second material is then welded, the interface being defined by the outer perimeter of the selected area.

15 . An article comprising: an array of cells, each of the cells including at least one cell wall defining an interior space, wherein the at least one cell wall includes a plurality of layers joined together during the bonding stage using the method as recited in any one of claims 11 to 14.