CLAIMS

1. Battery (1000) comprising at least one elementary cell (100), said elementary cell (100) comprising successively at least one planar anode current collector substrate (10), at least one anode layer (20), at least one layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), at least one cathode layer (50), and at least one planar cathode current collector substrate (40),

said battery (1000) comprising longitudinal edges (1011, 1012), a first lateral edge (1001) comprising at least one anode connection area (1002) and a second lateral edge (1005) comprising at least one cathode connection area (1006), said anode (1002) and cathode (1006) connection areas being preferably laterally opposite,

characterized in that each elementary cell (100) comprises a primary body (111), a secondary body (112) and a tertiary body (113), said secondary body and said tertiary body being arranged on either side of said primary body, with the understanding that each one of the primary (111), secondary (112) and tertiary (113) bodies comprises successively at least one planar anode current collector substrate (10), at least one anode layer (20), at least one layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), at least one cathode layer (50), and at least one planar cathode current collector substrate (40),

said secondary body (112) being separated from the primary body (111) by a notch (120) free from any anode, electrolyte, separator impregnated with an electrolyte, cathode and anode current collector substrate material,

with the understanding that said notch extends from a longitudinal edge (1011) to the opposite longitudinal edge of the battery (1012) in a direction perpendicular to the main plane of the battery, and

said tertiary body (113) being separated from the primary body (111) by a recess (130) free from any anode, electrolyte, separator impregnated with an electrolyte, cathode and cathode current collector substrate material, with the understanding that said recess (130) extends from a longitudinal edge (1011) to the opposite longitudinal edge of the battery (1012) in a direction perpendicular to the main plane of the battery.

2. Battery (1000) according to claim 1, comprising a plurality of elementary cells, characterized in that all the notches of each one of the elementary cells are superimposed, in a direction perpendicular to the main plane of the battery, in such a way that each planar cathode current collector substrate collects the cathode current of the elementary cell through the cathode connection area, and that all the recesses of each one of the elementary cells are superimposed, in a direction perpendicular to the main plane of the battery, in such a way that each planar anode current collector substrate collects the anode current of the elementary cell through the anode connection area.

3. Battery according to claim 1 or 2, characterized in that it comprises an encapsulation system entirely covering four of the six faces of said battery, the two remaining faces comprising an anode connection area and a cathode connection area.

4. Battery according to the preceding claim, characterized in that the encapsulation system comprises:
- at least one first cover layer, preferably selected from parylene, parylene F, polyimide, epoxy resins, silicone, polyamide, sol-gel silica, organic silica and/or a mixture thereof, deposited on the battery,
- at least one second cover layer comprised of an electrically-insulating material, deposited by atomic layer deposition on said at least first cover layer, with the understanding that this sequence of at least one first cover layer and of at least one second cover layer can be repeated z times with $z \geq 1$.

5. Battery according to any preceding claim, characterized in that the anode connection area and the cathode connection area are covered by terminations.

6. Battery according to the preceding claim, characterized in that the terminations comprise:
- a first layer of a material loaded with graphite, preferably with an epoxy resin base loaded with graphite disposed on at least the cathode connection area and/or at least the anode connection area,
- a second dense layer of metal copper disposed on the first layer of the termination system,
- optionally, a third layer with a tin-tin zinc alloy base, disposed on the second layer,
- optionally, a fourth layer with a tin base or with a base of a silver, palladium and copper alloy, disposed on the third layer of the termination system.

7. Battery according to any preceding claim, characterized in that the width of said notch is comprised between 0.01 mm and 0.5 mm.

8. Battery according to any preceding claim, characterized in that the width of said recess is comprised between 0.01 mm and 0.5 mm.

9. Battery according to any preceding claim, characterized in that the width of the secondary bodies is comprised between 0.5 mm and 20 mm.

10. Battery according to any preceding claim, characterized in that it is a lithium-ion battery.

11. Method for manufacturing a battery (1000), said battery comprising at least one elementary cell (100), said elementary cell (100) comprising successively at least one planar anode current collector substrate (10), at least one anode layer (20), at least one layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), at least one cathode layer (50), and at least one planar cathode current collector substrate (40), said method of manufacturing comprising:
(a) the providing of at least one foil of planar anode current collector substrate (10) covered with an anode layer (20), and optionally covered with a layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), called hereinafter anode foil (2), said anode foil comprising at least one anode slot (80), said anode slot (80) comprising two main vertical anode and parallel cavities (82), which are connected in

their upper portion by a horizontal anode channel (84), substantially perpendicular to the two main anode vertical cavities (82), these main vertical anode cavities being intended for delimiting the longitudinal edges of the battery,

(b) the providing of at least one foil of planar cathode current collector substrate (40) covered with a cathode layer (50), and optionally covered with a layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), called hereinafter cathode foil (5), said cathode foil comprising at least one cathode slot (70), said cathode slot comprising two main vertical cathode and parallel cavities (72), which are connected in their upper portion by a horizontal cathode channel (74), substantially perpendicular to the two main vertical cathode cavities (72), these main vertical cathode cavities being intended for delimiting the longitudinal edges of the battery,

(c) the carrying out of a first and of a second notches, in the vicinity of each anode (80), respectively cathode (70), slot of at least the foil supplied in step a), respectively in step b), in such a way as to form anode trenches (86, 88), respectively cathode trenches (76, 78), in a direction perpendicular to the main plane of the battery and in a direction parallel to the horizontal anode channel (84), of the anode slot (80), respectively to the horizontal cathode channel (74) of the cathode slot (70), with the understanding that

o the first and second notches are made on either side of the anode (2), respectively cathode (5) slot,

o the second notch is made in the extension of the first notch, and

o the anode trenches (86, 88), respectively the cathode trenches (76, 78), obtained from the first and second notches are free from any electrolyte material or separator impregnated with an electrolyte and from any anode material, respectively are free from any electrolyte material or separator impregnated with an electrolyte and from any cathode material, and

o said anode trenches (86, 88), respectively the cathode trenches (76, 78) extend between the opposite longitudinal edges (1011, 1012) of the battery in a direction perpendicular to the main plane of the battery in such a way as to connect the two main vertical anode and parallel cavities of each anode slot (80), respectively to connect the two main vertical cathode and parallel cavities of each cathode slot (70), the foil obtained after the carrying out of these notches being called hereinafter notched anode foil (2e), respectively notched cathode foil (5e),

(d) the carrying out of an alternating stack (1) of at least one notched anode foil (2e) and of at least one notched cathode foil (5e), in such a way as to obtain successively at least one planar anode current collector substrate (10), at least one anode layer (20), at least one layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), at least one cathode layer (50), and at least one planar cathode current collector substrate (40); in such way that, for each anode slot (80) of at least one notched anode foil (2e), respectively for each cathode slot (70) of at least one notched cathode foil (5e), the anode trenches (86, 88) of at least the notched anode foil, respectively the cathode trenches (76, 78), of at least the notched cathode foil

(5e), are disposed in the extension of the horizontal cathode channel (74) of the cathode slot (70) of the adjacent notched cathode foil (e), respectively of the horizontal anode channel (84) of the anode slot (80), of the adjacent notched anode foil (2e) in a direction perpendicular to the main plane of the battery,

(e) the carrying out of a heat treatment and/or of a mechanical compression of the stack of alternating foils obtained in step d), in such a way as to form a consolidated stack,

(f) the carrying out of two cuts (Dn, D'n) extending at least partially inside said anode (80), respectively cathode (70) slot, according to a plane parallel to the horizontal anode (84), respectively cathode (74) channel, the first cut extending between the horizontal anode channel (84) of the anode slot (80) and the end facing the longitudinal edges, while the second cut extends between the horizontal cathode channel (74) of the cathode slot (70) and the end facing the longitudinal edges, in such a way as to form a cut stack exposing at least the anode and cathode connection areas.

12. Method according to claim 11, characterized in that after step (e), a step (g) of encapsulating the consolidated stack is carried out, by depositing:

- at least one first cover layer, preferably selected from parylene, parylene F, polyimide, epoxy resins, silicone, polyamide, sol-gel silica, organic silica and/or a mixture thereof, on the battery, and then
- at least one second cover layer comprised of an electrically-insulating material, deposited by atomic layer deposition on said at least first cover layer,

with the understanding that the sequence of at least one first cover layer and of at least one second cover layer can be repeated z times with $z \geq 1$.

13. Method according to any of claims 11 or 12, characterized in that after step (f), the terminations of the battery are carried out by depositing successively on at least the anode and cathode connection areas:
- a first layer of a material loaded with graphite, preferably with an epoxy resin base loaded with graphite,
- a second dense layer of metal copper disposed on the first layer of the termination system, and
- optionally, a third layer with a tin-tin zinc alloy base, disposed on the second layer of the termination system,
- optionally, a fourth layer with a tin base or with a base of a silver, palladium and copper alloy, disposed on the third layer of the termination system.

14. Method according to any of claims 11 to 13, characterized in that the two notches made in step (d) forming trenches (76, 78, 86, 88) are carried out via laser ablation.

15. Method according to any of claims 10 to 14, characterized in that each cut is carried out via laser.

16. Method according to any of claims 11 to 15, characterized in that each elementary cell defines on a first face, a continuity area of the planar anode current collector substrate and an emerging notch (120), and on the opposite face, a continuity area of the planar cathode current collector substrate and an emerging recess (130).

17. Method according to any of claims 11 to 16, characterized in that the continuity area of the planar anode current collector substrate is located facing the notch (120), and the continuity area of the planar cathode current collector substrate is located facing the recess (130) in a direction perpendicular to the plane of the battery.

18. Method according to any of claims 11 to 17, characterized in that:

o the planar anode current collector substrate is the anode current collector substrate of two adjacent elementary cells, and in that

o the planar cathode current collector substrate is the cathode current collector substrate of two adjacent elementary cells.

CLAIMS

1. Battery (1000) comprising at least one elementary cell (100), said elementary cell (100) comprising successively at least one planar anode current collector substrate (10), at least one anode layer (20), at least one layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), at least one cathode layer (50), and at least one planar cathode current collector substrate (40),

said battery (1000) comprising longitudinal edges (1011, 1012), a first lateral edge (1001) comprising at least one anode connection area (1002) and a second lateral edge (1005) comprising at least one cathode connection area (1006), said anode (1002) and cathode (1006) connection areas being preferably laterally opposite,

characterized in that each elementary cell (100) comprises a primary body (111), a secondary body (112) and a tertiary body (113), said secondary body and said tertiary body being arranged on either side of said primary body, with the understanding that each one of the primary (111), secondary (112) and tertiary (113) bodies comprises successively at least one planar anode current collector substrate (10), at least one anode layer (20), at least one layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), at least one cathode layer (50), and at least one planar cathode current collector substrate (40),

said secondary body (112) being separated from the primary body (111) by a notch (120) free from any anode, electrolyte, separator impregnated with an electrolyte, cathode and anode current collector substrate material,

with the understanding that said notch extends from a longitudinal edge (1011) to the opposite longitudinal edge of the battery (1012) in a direction perpendicular to the main plane of the battery, and

said tertiary body (113) being separated from the primary body (111) by a recess (130) free from any anode, electrolyte, separator impregnated with an electrolyte, cathode and cathode current collector substrate material, with the understanding that said recess (130) extends from a longitudinal edge (1011) to the opposite longitudinal edge of the battery (1012) in a direction perpendicular to the main plane of the battery.

2. Battery (1000) according to claim 1, comprising a plurality of elementary cells, characterized in that all the notches of each one of the elementary cells are superimposed, in a direction perpendicular to the main plane of the battery, in such a way that each planar cathode current collector substrate collects the cathode current of the elementary cell through the cathode connection area, and that all the recesses of each one of the elementary cells are superimposed, in a direction perpendicular to the main plane of the battery, in such a way that each planar anode current collector substrate collects the anode current of the elementary cell through the anode connection area.

3. Battery according to claim 1 or 2, characterized in that it comprises an encapsulation system entirely covering four of the six faces of said battery, the two remaining faces comprising an anode connection area and a cathode connection area.

4. Battery according to claim 3, characterized in that the encapsulation system comprises:

- at least one first cover layer, preferably selected from parylene, parylene F, polyimide, epoxy resins, silicone, polyamide, sol-gel silica, organic silica and/or a mixture thereof, deposited on the battery,

- at least one second cover layer comprised of an electrically-insulating material, deposited by atomic layer deposition on said at least first cover layer, with the understanding that this sequence of at least one first cover layer and of at least one second cover layer can be repeated z times with $z \geq 1$.

5. Battery according to any preceding claim, characterized in that the anode connection area and the cathode connection area are covered by terminations.

6. Battery according to claim 5, characterized in that the terminations comprise:

- a first layer of a material loaded with graphite, preferably with an epoxy resin base loaded with graphite disposed on at least the cathode connection area and/or at least the anode connection area,

- a second dense layer of metal copper disposed on the first layer of the termination system,

- optionally, a third layer with a tin-tin zinc alloy base, disposed on the second layer,

- optionally, a fourth layer with a tin base or with a base of a silver, palladium and copper alloy, disposed on the third layer of the termination system.

7. Battery according to any preceding claim, characterized in that the width of said notch is comprised between 0.01 mm and 0.5 mm.

8. Battery according to any preceding claim, characterized in that the width of said recess is comprised between 0.01 mm and 0.5 mm.

9. Battery according to any preceding claim, characterized in that the width of the secondary bodies is comprised between 0.5 mm and 20 mm.

10. Battery according to any preceding claim, characterized in that it is a lithium-ion battery.

11. Method for manufacturing a battery (1000), said battery comprising at least one elementary cell (100), said elementary cell (100) comprising successively at least one planar anode current collector substrate (10), at least one anode layer (20), at least one layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), at least one cathode layer (50), and at least one planar cathode current collector substrate (40), said method of manufacturing comprising:
(a) the providing of at least one foil of planar anode current collector substrate (10) covered with an anode layer (20), and optionally covered with a layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), called hereinafter anode foil (2), said anode foil comprising at least one anode slot (80), said anode slot (80) comprising two main vertical anode and parallel cavities (82), which are connected in

their upper portion by a horizontal anode channel (84), substantially perpendicular to the two main anode vertical cavities (82), these main vertical anode cavities being intended for delimiting the longitudinal edges of the battery,

(b) the providing of at least one foil of planar cathode current collector substrate (40) covered with a cathode layer (50), and optionally covered with a layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), called hereinafter cathode foil (5), said cathode foil comprising at least one cathode slot (70), said cathode slot comprising two main vertical cathode and parallel cavities (72), which are connected in their upper portion by a horizontal cathode channel (74), substantially perpendicular to the two main vertical cathode cavities (72), these main vertical cathode cavities being intended for delimiting the longitudinal edges of the battery,

(c) the carrying out of a first and of a second notches, in the vicinity of each anode (80), respectively cathode (70), slot of at least the foil supplied in step a), respectively in step b), in such a way as to form anode trenches (86, 88), respectively cathode trenches (76, 78), in a direction perpendicular to the main plane of the battery and in a direction parallel to the horizontal anode channel (84), of the anode slot (80), respectively to the horizontal cathode channel (74) of the cathode slot (70), with the understanding that

o the first and second notches are made on either side of the anode (2), respectively cathode (5) slot,

o the second notch is made in the extension of the first notch, and

o the anode trenches (86, 88), respectively the cathode trenches (76, 78), obtained from the first and second notches are free from any electrolyte material or separator impregnated with an electrolyte and from any anode material, respectively are free from any electrolyte material or separator impregnated with an electrolyte and from any cathode material, and

o said anode trenches (86, 88), respectively the cathode trenches (76, 78) extend between the opposite longitudinal edges (1011, 1012) of the battery in a direction perpendicular to the main plane of the battery in such a way as to connect the two main vertical anode and parallel cavities of each anode slot (80), respectively to connect the two main vertical cathode and parallel cavities of each cathode slot (70), the foil obtained after the carrying out of these notches being called hereinafter notched anode foil (2e), respectively notched cathode foil (5e),

(d) the carrying out of an alternating stack (1) of at least one notched anode foil (2e) and of at least one notched cathode foil (5e), in such a way as to obtain successively at least one planar anode current collector substrate (10), at least one anode layer (20), at least one layer of an electrolyte material (30) or of a separator impregnated with an electrolyte (31), at least one cathode layer (50), and at least one planar cathode current collector substrate (40); in such way that, for each anode slot (80) of at least one notched anode foil (2e), respectively for each cathode slot (70) of at least one notched cathode foil (5e), the anode trenches (86, 88) of at least the notched anode foil, respectively the cathode trenches (76, 78), of at least the notched cathode foil

(5e), are disposed in the extension of the horizontal cathode channel (74) of the cathode slot (70) of the adjacent notched cathode foil (e), respectively of the horizontal anode channel (84) of the anode slot (80), of the adjacent notched anode foil (2e) in a direction perpendicular to the main plane of the battery,

(e) the carrying out of a heat treatment and/or of a mechanical compression of the stack of alternating foils obtained in step d), in such a way as to form a consolidated stack,

(f) the carrying out of two cuts (Dn, D'n) extending at least partially inside said anode (80), respectively cathode (70) slot, according to a plane parallel to the horizontal anode (84), respectively cathode (74) channel, the first cut extending between the horizontal anode channel (84) of the anode slot (80) and the end facing the longitudinal edges, while the second cut extends between the horizontal cathode channel (74) of the cathode slot (70) and the end facing the longitudinal edges, in such a way as to form a cut stack exposing at least the anode and cathode connection areas.

12. Method according to claim 11, characterized in that after step (e), a step (g) of encapsulating the consolidated stack is carried out, by depositing:

- at least one first cover layer, preferably selected from parylene, parylene F, polyimide, epoxy resins, silicone, polyamide, sol-gel silica, organic silica and/or a mixture thereof, on the battery, and then
- at least one second cover layer comprised of an electrically-insulating material, deposited by atomic layer deposition on said at least first cover layer,

with the understanding that the sequence of at least one first cover layer and of at least one second cover layer can be repeated z times with $z \geq 1$.

13. Method according to any of claims 11 or 12, characterized in that after step (f), the terminations of the battery are carried out by depositing successively on at least the anode and cathode connection areas:
- a first layer of a material loaded with graphite, preferably with an epoxy resin base loaded with graphite,
- a second dense layer of metal copper disposed on the first layer of the termination system, and
- optionally, a third layer with a tin-tin zinc alloy base, disposed on the second layer of the termination system,
- optionally, a fourth layer with a tin base or with a base of a silver, palladium and copper alloy, disposed on the third layer of the termination system.

14. Method according to any of claims 11 to 13, characterized in that the two notches made in step (d) forming trenches (76, 78, 86, 88) are carried out via laser ablation.

15. Method according to any of claims 10 to 14, characterized in that each cut is carried out via laser.

16. Method according to any of claims 11 to 15, characterized in that each elementary cell defines on a first face, a continuity area of the planar anode current collector substrate and an emerging notch (120), and on the opposite face, a continuity area of the planar cathode current collector substrate and an emerging recess (130).

17. Method according to any of claims 11 to 16, characterized in that the continuity area of the planar anode current collector substrate is located facing the notch (120), and the continuity area of the planar cathode current collector substrate is located facing the recess (130) in a direction perpendicular to the plane of the battery.

18. Method according to any of claims 11 to 17, characterized in that:

o the planar anode current collector substrate is the anode current collector substrate of two adjacent elementary cells, and in that

o the planar cathode current collector substrate is the cathode current collector substrate of two adjacent elementary cells.