CLAIMS

1. A method for manufacturing a solid electrolyte (13, 23), preferably as a thin layer, for lithium-ion battery or supercapacitor, deposited on an electrode (12, 22), comprising the steps of:
   a. providing a conductive substrate (11, 21), covered beforehand with a layer of material that can be used as an electrode ("electrode layer"),
   b. deposition on said electrode layer of an electrolyte layer (13, 23), preferably by electrophoresis or by dip-coating, from a suspension of core-shell particles comprising, as a core, a particle of a material that can be used as an electrolyte and/or electronic insulator, on which a shell comprising PEO is grafted;
   c. drying the electrolyte layer (13, 23) thus obtained, preferably in an airflow;
   d. optionally, densifying said electrolyte layer by mechanical compression and/or heat treatment.

2. The method according to claim 1, wherein the core-shell particles have an average size D_{50} of primary core particles of less than 100 nm, preferably less than 50 nm and even more preferably less than or equal to 30 nm.

3. The method according to claim 1 or 2, wherein said core particles are obtained by hydrothermal or solvothermal synthesis.

4. The method according to any of claims 1 to 3, wherein the shell of the core-shell particles has a thickness comprised between 1 nm and 100 nm.

5. The method according to any of claims 1 to 4, wherein the electrolyte layer obtained in step c) or d) has a thickness less than 10 µm, preferably less than about 6 µm.

6. The method according to any of claims 1 to 5, wherein the PEO has a weight average molar weight less than 7,000 g/mol, preferably about 5,000 g/mol.

7. The method according to any of claims 1 to 6, wherein the suspension of core-shell particles used in step b) has a dry extract less than 30% by weight.

8. Use of a method according to any one of claims 1 to 7 for the manufacture of solid electrolytes, preferably in a thin layer, in electronic, electrical or electrotechnical devices and preferably in devices selected in the group composed of batteries, capacitors, supercapacitors, capacities, resistors, inductors, transistors.

9. A solid electrolyte, preferably in a thin layer, that can be obtained by the method according to any of claims 1 to 7.

10. The solid electrolyte, preferably in a thin layer, according to claim 9, comprising a solid electrolyte and PEO characterized in that it has a volume ratio of solid electrolyte / PEO greater than 35%, preferably greater than 50%, preferably greater than 60%, and even more preferably greater than 70%.

11. The solid electrolyte, preferably in a thin layer, according to claim 9 or 10, characterized in that it has a porosity less than 20%, preferably less than 15%, more preferably less than 10%.

12. An electrochemical device comprising at least one solid electrolyte, preferably in a thin layer, according to any of claims 9 or 10 or 11, preferably a lithium-ion battery or a supercapacitor.

13. A process for manufacturing a lithium-ion battery (1) implementing the method according to any of claims 1 to 7, and comprising the steps of:

i. Providing at least two conductive substrates (11, 21) that be used as current collectors of the battery, covered beforehand with a layer of a material that can be used as an anode and respectively as a cathode ("anode layer" (12) respectively "cathode layer" (22), and being covered over at least one portion of at least one of their faces with a cathode layer, respectively anode layer,

ii. Providing of a colloidal suspension comprising core-shell nanoparticles comprising as a core, a particle of a material that can be used as an electrolyte and/or electronic insulator, on which a shell comprising PEO is grafted,

iii. Deposition of an electrolyte layer (13, 23), preferably by electrophoresis or by dip-coating, from a suspension comprising core-shell particles obtained in step ii), on a cathode layer, and/or anode layer obtained in step i), to obtain and first and/or a second intermediate structure,

iv. Drying of the layer thus obtained in step iii), preferably in an air flow,

v. Creating a stack from said first and/or second intermediate structure to obtain a stack of the "substrate / anode / electrolyte / cathode / substrate" type:
- either by depositing an anode layer **12** on said first intermediate structure,
- either by depositing a cathode layer **22** on said second intermediate structure,
- or by superposing said first intermediate structure and said second intermediate structure in such a way that the two electrolyte layers are placed one on the other,

vi. Densification of the stack obtained in the preceding step by mechanical compression and/or heat treatment of the stack leading to the obtaining of a battery.

14. The process according to claim 13, wherein the cathode is a dense electrode
or a dense electrode coated by ALD or chemically in a solution CSD with an electronically-insulating layer, preferably an electronically insulating and ionic conducting layer,
or a porous electrode,
or a porous electrode coated by ALD or chemically in a solution CSD with an electronically-insulating layer, preferably an electronically insulating and ionic conducting layer,
or, preferably, a mesoporous electrode,
or a mesoporous electrode coated by ALD or chemically in a solution CSD with an electronically-insulating layer, preferably an electronically insulating and ionic conducting layer,
and/or wherein the anode is a dense electrode
or a dense electrode coated by ALD or chemically in a solution CSD with an electronically-insulating layer, preferably an electronically insulating and ionic conducting layer,
or a porous electrode
or a porous electrode coated by ALD or chemically in a solution CSD with an electronically-insulating layer, preferably an electronically insulating and ionic conducting layer,
or, preferably, a mesoporous electrode,
or a mesoporous electrode coated by ALD or chemically in a solution CSD with an electronically-insulating layer, preferably an electronically insulating and ionic conducting layer.

15. The process according to any of claims 13 to 14, wherein after step vi):

- is deposited successively, alternating, on the battery:
    - at least one first layer of parylene and/or polymide on said battery,
    - at least one second layer composed of an electrically-insulating material by ALD (Atomic Layer Deposition) on said first layer of parylene and or polyimide,
    - and on the alternating succession of at least one first and of at least one second layer is deposited a layer making it possible to protect the battery from mechanical damage of the battery, preferably made of silicone, epoxy resin, or parylene, thus forming, an encapsulation system of the battery,
- the battery thus encapsulated is cut along two cutting planes to expose on each one of the cutting plans anode and cathode connections of the battery, in such a way that the encapsulation system covers four of the six faces of said battery, preferably continuously,
- is deposited successively, on and around, these anode and cathode connections (50):
    - a first electrically-conductive layer, optional, preferably deposited by ALD,
    - a second layer with an epoxy resin base charged with silver, deposited on the first electronically-conductive layer, and
    - a third layer with a nickel base, deposited on the second layer, and
    - a fourth layer with a tin or copper base, deposited on the third layer.

16. The process according to any of claims 13 to 14, wherein after step vi):

- is deposited successively, alternating, on the battery, an encapsulation system (30) formed by a succession of layers, namely a sequence, preferably z sequences, comprising:
    - a first covering layer, preferably chosen from parylene, parylene of the F type, polyimide, epoxy resins, silicone, polyamide and/or a mixture of the latter, deposited on the assembled stack,
    - a second covering layer comprised of an electrically-insulating material, deposited by atomic layer deposition on said first covering layer,
    - this sequence can be repeated z times with $z \geq 1$,

- a last covering layer is deposited in this succession of layers of a material chosen from epoxy resin, polyethylene naphthalate (PEN), polyimide, polyamide, polyurethane, silicone, sol-gel silica or organic silica,
- the battery thus encapsulated is cut along two cutting planes to expose on each one of the cutting plans anode and cathode connections of the battery, in such a way that the encapsulation system covers four of the six faces of said battery, preferably continuously,
- is deposited successively, on and around, these anode and cathode connections (50):
    - a first layer of a material charged with graphite, preferably epoxy resin charged with graphite,
    - a second layer comprising metal copper obtained from an ink charged with nanoparticles of copper deposited on the first layer,
- the layers obtained are thermally treated, preferably by infrared flash lamp in such a way as to obtain a covering of the cathode and anode connections by a layer of metal copper,
- possibly, is deposited successively, on and around, this layer of metal copper:
    - a first layer of a tin-zinc alloy deposited, preferably by dipping in a molten tin-zinc bath, so as to ensure the tightness of the battery at least cost, and
    - a second layer with a pure tin base deposited by electrodeposition or a second layer comprising an alloy with a silver, palladium and copper base deposited on this first layer of a tin-zinc alloy.

17. The process according to claim 15, wherein the anode and cathode connections (50) are on the opposite sides of the stack.

18. A lithium-ion battery (1) able to be obtained by the process according to any of claims 13 to 16.