CLAIMS

1. A method for making an electrode (11) for an ionic liquid-based supercapacitor comprising two electrodes comprising an anode and a cathode separated by an electrolyte separator comprising an ionic polymer with an ionic liquid, comprising:
   - a step for making a carbon paste (6) resulting from mixing (II) carbon materials (5), ionic liquids (2) and a binder (4), so as to obtain an active material (6) for said electrode (11) at room temperature,
   - a step (III) for forming said electrode (11) from mechanically processing said active material (6), wherein the carbon paste comprises at least 10 to 40 in weight percentage of active material and 0 to 10 in weight percentage of binder mixed in 60 to 90 in weight percentage of electrolyte for 100% weight of the carbon paste.

2. The method of Claim 1, wherein the electrode forming step (III) implements a paste rolling technique.

3. The method of Claim 2, wherein the paste rolling technique implements a calendaring machine.

4. The method of any of preceding Claims, wherein the electrode forming step implements a paste 3D printing technique.

5. The method of any Claims 1 to 3, wherein the electrode forming step implements a paste stamping technique.

6. The method of any Claims 1 to 3, wherein the electrode forming step implements an extrusion technique.

7. The method of any Claims 1 to 3, wherein the electrode forming step implements a jet milling technique.

8. The method of any of preceding Claims, wherein ionic liquids are also used to mix the carbon materials (5) with the binder (4).

9. The method of any of preceding Claims, wherein the ionic liquids (IL) comprise a high quality without which such results cannot be achieved, the ionic liquids comprising: Purity 99.9%; H20 ≤20ppm; halides ≤ 1ppm; Lithium, Sodium et Potassium ≤ 10ppm; Organic nitrogen compounds ≤ 10ppm; Colour test 20-10 Hazen; cations that are selected among the group of the alkyl imidazolium, alkyl pyrrolidinium, morpholinium based, pyridinium based, phosphonium-based, ammonium-based; and anions that are selected among the group of bis(trifluoromethanesulfonyl)imide (TFSI), bis(fluorosulfonyl)imide (FSI), dicyanamide (DCA), 4,5-dicyano-2-(trifluoromethyl)imidazolide (TDI),Fluorosulfonyl-(trifluoromethanesulfonyl)imide (FTFSI).

10. The method of any of preceding Claims, wherein the mass percentage of electrolyte of the processed electrode is comprised in the range 60%-90%.

11. An apparatus for making an electrode for an ionic liquid-based supercapacitor comprising two electrodes comprising an anode and a cathode separated by an electrolyte separator made of an ionic polymer and ionic liquids (IL), comprising:

    - means (1) for making a carbon paste (6) resulting from mixing carbon materials (5), ionic liquids (2) and a binder (4), so as to obtain an active material (6) for said electrode at room temperature,

    - means (10) for forming said electrode from mechanically processing said active material (6), wherein the carbon paste comprises at least 10 to 40 in weight percentage of active material and 0 to 10 in weight percentage of binder mixed in 60 to 90 in weight percentage of electrolyte for 100% weight of the carbon paste.

12. The apparatus of Claim 9, wherein the forming means (10) comprise a calendaring machine (7,8,9).

13. A combination of an electrode and of an electrolyte for an ionic liquid-based supercapacitor, wherein said electrode is made by implementing the method according to any of Claims 1 to 8.

14. The electrode-electrolyte combination of Claim 13, wherein the electrolyte percentage in the carbon based electrode can be advantageously comprised in the range 60%-90%.

15. A supercapacitor comprising a stack of a cathode electrode, an electrolyte separator and an anode electrode, said cathode and anode electrodes being electrically connected to current collectors, wherein said electrolyte separator comprises an ionic polymer with an ionic liquid (IL) and said electrodes comprise at least 10 to 40 in weight percentage of a carbon-based active material (5) mixed with 60 to 90 in weight percentage of an ionic liquid electrolyte (2) and 0 to 10 in weight percentage of a binder (4).

16. The supercapacitor of Claim 15, wherein the ionic liquid (IL) of the electrolyte separator and the ionic liquid of the electrodes are distinct.

17. The supercapacitor of Claim 15 or 16, wherein the ionic polymer electrolyte is made up of an ionic polymer and of ionic liquids (IL), the ratio of ionic liquid to ionic polymer being selected so as to get a self-standing electrolyte separator.

18. The supercapacitor of any of preceding Claims 15 to 17, characterized in that it is adapted to match a specific support shape.

19. The supercapacitor of Claim 16, wherein the support is flexible.

20. The supercapacitor of any Claims 15 to 19, wherein the current collectors are printed or deposited collecting devices.

21. A method for making a supercapacitor, from electrodes formed from carbon paste resulting from mixing carbon materials, ionic liquids and a binder, so as to obtain an active material for said electrode at room temperature, and from an electrolyte separator comprising an ionic polymer with an ionic liquid electrolyte, wherein the carbon paste comprises at least 10 to 40 in weight percentage of active material and 0 to 10 in weight percentage of binder mixed in 60 to 90 in weight percentage of ionic liquid electrolyte for 100% weight of the carbon paste.

22. The method for making a supercapacitor of Claim 21, comprising:

- a step for providing a first current collector,
- a step for forming on said first collector a first electrode from a first carbon paste resulting from mixing carbon materials, ionic liquids and a binder, so as to obtain an active material for said electrode at room temperature.
- a step for providing on said first electrode an electrolyte separator comprising an ionic polymer with an ionic liquid,
- a step for providing a second current collector,
- a step for forming on said second collector a second electrode from a second carbon paste resulting from mixing carbon materials, ionic liquids and a binder, and
- a step for assembling said second collector and electrode, said electrolyte separator, said first collector and electrode.