WHAT IS CLAIMED IS:

1. A solid electrolyte producing system comprising:

a supercapacitor desalination device comprising a power supply and a supercapacitor desalination unit, the supercapacitor desalination unit comprising a pair of electrodes electrically coupled to the power supply and operable in a charging mode of operation and a discharging mode of operation;

a feeding source configured to provide a feed liquid to the supercapacitor desalination unit when the supercapacitor desalination unit is in the charging mode of operation, the feed liquid comprising at least one determined electrolyte; and

a crystallization device receiving a concentrated liquid from the supercapacitor desalination device in the discharging mode of operation, the concentrated liquid being a saturated liquid or supersaturated liquid of the at least one determined type of electrolyte, the at least one determined type of electrolyte precipitating in the crystallization device as solid electrolyte; and

a separation device separating the solid electrolyte from the liquid of the crystallization device as a solid electrolyte product.

2. The system of claim 1, wherein each of the pair of electrodes comprises a porous conductive portion and a current collector attached to the porous conductive portion.

3. The system of claim 2, wherein the porous conductive portion has a Brunauer-Emmet-Teller (BET) surface area in a range of from about 2.0 to about 5.5×10^6 ft^2 lb^{-1}.

4. The system of claim 3, wherein the porous conductive portion comprises carbon, carbon nanotubes, graphite, carbon fiber, carbon cloth, carbon aerogel, metallic powders, conductive polymers, or any mixture thereof.

5. The system of claim 1, wherein the supercapacitor desalination unit comprises a flow spacer between the pair of electrodes.

6. The system of claim 1, wherein the supercapacitor desalination device comprises a plurality of supercapacitor desalination units.

7. The system of claim 1 further comprising a plurality of seed particles disposed within the crystallization device to induce precipitation.

8. The system of claim 1, wherein the feed liquid comprises at least two types of dissolved electrolytes, wherein the system further comprises a controller configured to control that the concentrated liquid in the crystallization device is a saturated or supersaturated water of one of the at least two types of electrolytes, and is under-saturated with the other of the at least two types of electrolytes, and wherein the electrolyte saturated or supersaturated in water precipitates in the crystallization device.

9. The system of claim 8, wherein the controller is configured to calculate a saturation rate of each of the at least two types of dissolved electrolytes in the concentrated liquid, and control the saturation rate of one of the at least two types of electrolytes to be higher than or equal to 1, and control the saturation rate of the other of the at least two types of electrolytes to be less than 1.

10. The system of claim 9, wherein the feed liquid is also controlled to flow to the crystallization device for balancing when the saturation rate of the other of the at least two types of electrolytes is near to 1.

11. The system of claim 8 further comprising a second supercapacitor device, a second crystallization device and a second separation device, wherein after removal of solid electrolyte, a liquid from the first crystallization device is used as a feed liquid for the second supercapacitor desalination device during the discharging mode of the second supercapacitor desalination device.

12. The system of claim 11, wherein a concentrated liquid from the second supercapacitor device comprises a saturated or supersaturated electrolyte of both of

the at least two types of electrolytes, and is received by the second crystallization device, and wherein both of the at least two types of electrolytes precipitate as solid electrolytes, and are removed from the second crystallization device by the second separation device.

13. The system of claim 1, wherein the seperation device comprises comprises a settling tank, a filter press, a microfilter, an ultrafilter, a hydrocyclone, or a centrifuge.

14. A method for producing solid electrolyte comprising:

adsorbing dissolved electrolyte ions from a feed liquid using a supercapacitor desalination unit during a charging step;

desorbing ions from the supercapacitor desalination unit into a concentrated liquid during a discharge step;

passing the concentrated liquid into a crystallization device for precipitating the dissolved electrolyte ions of the concentrated liquid as a solid electrolyte in the crystallization device; and

separating the solid electrolyte from the concentrated liquid as an electrolyte product.

15. The method of claim 14, wherein the feed liquid comprises at least two types of dissolved electrolytes.

16. The method of claim 15 further comprising controlling the concentrated liquid to be saturated or supersaturated with one of the at least two types of electrolytes, and to be under-saturated with the other of the at least two types of electrolytes.

17. The method of claim 16, wherein controlling comprises measuring concentrations of the at least two types of electrolytes in the concentrated liquid and calculating the concentration rate of each of the at least two types of electrolytes, and controlling the saturation rate of one of the two types of electrolytes to be equal to or larger than 1, and controlling the saturation rate of the other of the two types of electrolytes to be lower than 1.

WHAT IS CLAIMED IS:

1. A solid electrolyte producing system comprising:

first and second supercapacitor desalination devices each comprising at least one supercapacitor desalination unit, each supercapacitor desalination unit comprising a pair of electrodes electrically coupled to a power supply and operable in a charging mode of operation and a discharging mode of operation;

a feeding source configured to provide a feed liquid to the first supercapacitor desalination unit when the first supercapacitor desalination unit is in the charging mode of operation, the feed liquid comprising at least two determined electrolytes;

a first crystallization device configured to receive a concentrated liquid comprising the at least two determined electrolytes from the first supercapacitor desalination unit in the discharging mode of operation, and to precipitate a single one of the at least two determined electrolytes;

a second crystallization device configured to receive a concentrated liquid from the second supercapacitor desalination unit in the discharging mode of operation, and to precipitate a mixture of the at least two determined electrolytes; and

first and second separation devices configured to separate solid electrolytes from liquids from the respective first and second crystallization devices as solid electrolyte products;

wherein the second supercapacitor desalination unit is configured to receive the liquid from the first separation device for introduction into the second crystallization device for precipitating the mixture of the at least two determined electrolytes, and wherein the precipitate of the at least two determined electrolytes are based on saturated or supersaturated concentrations thereof, produced by circulation of the at least two determined electrolytes through the respective first and second supercapacitor desalination units in the discharging mode of operation.

2. The system of claim 1, wherein each of the pair of electrodes comprises a porous conductive portion and a current collector attached to the porous conductive portion.

3. The system of claim 2, wherein the porous conductive portion has a Brunauer-Emmet-Teller (BET) surface area in a range of from about 2.0 to about 5.5×106 ft2lb−1.

4. The system of claim 3, wherein the porous conductive portion comprises carbon, carbon nanotubes, graphite, carbon fiber, carbon cloth, carbon aerogel, metallic powders, conductive polymers, or any mixture thereof.

5. The system of claim 1, wherein each supercapacitor desalination unit comprises a flow spacer between the pair of electrodes.

6. The system of claim 1, wherein each of the first and second supercapacitor desalination device comprise a plurality of supercapacitor desalination units.

7. The system of claim 1 further comprising a plurality of seed particles disposed within the first and second crystallization devices to induce precipitation.

8. The system of claim 1, wherein the system further comprises a controller configured to control that the concentrated liquid in the first crystallization device is saturated or supersaturated water of one of the at least two types of electrolytes, and is under-saturated water with the other of the at least two types of electrolytes, and wherein the electrolytes saturated or supersaturated in water precipitate in the first crystallization device.

9. The system of claim 8, wherein the controller is configured to calculate a saturation rate of each of the at least two types of dissolved electrolytes in the concentrated liquid, and control the saturation rate of one of the at least two types of electrolytes to be higher than or equal to 1, and control the saturation rate of the other of the at least two types of electrolytes to be less than 1.

10. The system of claim 9, wherein the feed liquid is also controlled to flow to the first crystallization device for balancing when the saturation rate of the other of the at least two types of electrolytes is near to 1.

11. The system of claim 1, wherein each of the first and second separation devices comprise a settling tank, a filter press, a microfilter, an ultrafilter, a hydrocyclone, or a centrifuge.

12. A method for producing solid electrolyte comprising:

adsorbing ions of at least two dissolved electrolytes from a feed liquid using first and second supercapacitor desalination units during a charging step;

desorbing the ions from the first and second supercapacitor desalination units into respective concentrated liquids during a discharge step;

passing the concentrated liquid comprising at least two dissolved electrolytes from the first supercapacitor desalination unit into a first crystallization device for precipitating a single one of the at least two dissolved electrolytes;

passing the concentrated liquid from the second supercapacitor desalination unit into a second crystallization device for precipitating the other a mixture of the at least two dissolved electrolytes; and

separating, by first and second separation device, solid electrolytes from the respective concentrated liquids as electrolyte products;

wherein the second supercapacitor desalination unit is configured to receive the concentrated liquid from the first crystallization device first separation device for introduction into the second crystallization device for precipitating the mixture of the at least two dissolved electrolytes, and wherein the precipitate of the at least two determined electrolytes are based on saturated or supersaturated concentrations thereof, produced by circulation of the at least two determined electrolytes through the respective first and second supercapacitor desalination units in the discharging mode of operation.

13. The method of claim 12, further comprising controlling the concentrated liquid in the first crystallization device to be saturated or supersaturated with one of the at least two types of electrolytes, and to be under-saturated with the other of the at least two types of electrolytes.

14. The method of claim 13, wherein controlling comprises measuring concentrations of the at least two types of electrolytes in the concentrated liquid and calculating the concentration rate of each of the at least two types of electrolytes, and controlling the saturation rate of one of the two types of electrolytes to be equal to or larger than 1, and controlling the saturation rate of the other of the two types of electrolytes to be lower than 1.