CLAIMS

1. A method for generating a zeolite-templated carbon (ZTC) for use as an active material in an electrode in a supercapacitor, the method comprising the steps of:

providing a CaX zeolite at a select size;

performing carbon vapor deposition on the CaX zeolite in a plug-flow reactor using an organic precursor to generate a ZTC-zeolite composition, wherein the carbon vapor deposition occurs at an elevated temperature;

cooling the ZTC-zeolite composition; then

heating the ZTC-zeolite composition by introducing an inert gas stream for a defined period of time, wherein the ZTC is heated to a graphitizing temperature in the range of 820 K to 1180 K, to generate a graphitized ZTC-zeolite composition;

cooling the graphitized ZTC-zeolite composition; and

washing the graphitized ZTC-zeolite composition with acid to generate a prepared ZTC, the prepared ZTC having a select surface area and operable for use as an active material in an electrode in a supercapacitor.

2. The method of claim 1, wherein the inert gas stream comprises helium.

3. The method of any of claims 1-2, wherein the inert gas stream comprises nitrogen.

4. The method of any of claims 1-3, wherein the organic precursor is selected from the group consisting of: propylene, ethanol, acetylene, and combinations of the same.

5. The method of any of claims 1-3, wherein the organic precursor comprises propylene.

6. The method of any of claims 1-5, wherein the acid is selected from the group consisting of: HCl, HF, and combinations of the same.

7. The method of any of claims 1-6, further comprising the step of drying the prepared ZTC.

8. The method of any of claims 1-7, wherein the prepared ZTC defines micropores in the range of 1.5 to 2 nm and mesopores in the range of 2 to 5 nm.

9. The method of any of claims 1-8, wherein the elevated temperature is in the range of 800 K to 1080 K.

10. A supercapacitor comprising:

an electrode, the electrode comprising an active material and a metallic component, wherein the active material comprises a zeolite-templated (ZTC) generated by the method of claim 1;

an electrolyte comprising H_2SO_4; and

a membrane separator.

11. The supercapacitor of claim 10, wherein the supercapacitor retains a maximum of 75% of capacitance at high current densities of 15 A/g.

12. The supercapacitor of any of claims 10-11, wherein the ZTC has a surface area in the range of 2500 m^2/g to 3000 m^2/g.

13. The supercapacitor of any of claims 10-12, wherein the ZTC has a micropore density of greater than 1.0 cm^3/g.

14. The supercapacitor of any of claims 10-13, wherein the supercapacitor has a capacitance is in the range of 100 to 250 F/g.

15. A method for generating a zeolite-templated carbon (ZTC) for use as an active material in an electrode in a supercapacitor, the method comprising the steps of:

providing a NaX zeolite;

initiating ion exchange with the NaX zeolite and Ca^{+2} ions to generate a large crystalline calcium (LCaX) zeolite;

performing carbon vapor deposition on the LCaX zeolite in a plug-flow reactor using acetylene to generate a ZTC-zeolite composition, wherein the carbon vapor deposition occurs at an elevated temperature;

heating the ZTC by introducing an inert gas stream for a defined period of time, wherein the ZTC is heated to a graphitizing temperature in the range of 820 K to 1180 K, generating a graphitized ZTC-zeolite composition;

cooling the graphitized ZTC-zeolite composition; and

washing the graphitized ZTC-zeolite composition with acid, generating a prepared ZTC, the prepared ZTC having a select surface area and operable for use as an active material in an electrode in a supercapacitor.

16. The method of claim 15, wherein the inert gas stream comprises helium.

17. The method of any of claims 15-16, wherein the elevated temperature is in the range of 820 K to 873 K.

18. The method of any of claims 15-17, further comprising the steps of:

performing a second carbon vapor deposition on the graphitized ZTC-zeolite composition using acetylene, wherein the second carbon vapor deposition is performed at the elevated temperature.

19. The method of any of claims 15-16 or 18, wherein the elevated temperature is in the range of 800 K to 873 K.

20. The method of any of claims 15-19, wherein the acid is selected from the group consisting of: HCl, HF, and combinations of the same.