## CLAIMS

1. A method of forming a polyimide aerogel, the method comprising:

providing an aqueous solution of a polyamic acid salt, the polyamic acid salt comprising a polyamic acid including carboxylic acid groups, wherein the carboxylic acid groups are associated with cationic species and are substantially present as carboxylate anions;

imidizing the polyamic acid salt to form a polyimide gel; and

drying the polyimide gel to form the polyimide aerogel.

2. The method of claim 1, wherein providing the aqueous solution of the polyamic acid salt comprises:

providing a polyamic acid;

adding the polyamic acid to water to form an aqueous suspension of the polyamic acid; and

adding a base to the aqueous suspension of the polyamic acid to form the aqueous solution of the polyamic acid salt.

3. The method of claim 2, wherein the base is an alkali metal hydroxide, and wherein the cationic species is an alkali metal cation.

4. The method of claim 3, wherein the alkali metal hydroxide is lithium hydroxide, sodium hydroxide, or potassium hydroxide.

5. The method of claim 2, wherein the base is a non-nucleophilic amine, and wherein the cationic species is an ammonium cation.

~~6. The method of claim 5, wherein the non-nucleophilic amine has a solubility of at least about 4 grams per 1 L of water at 20°C.~~

~~7. The method of claim 5, wherein the non-nucleophilic amine is a tertiary amine.~~

~~8. The method of claim 5, wherein the non-nucleophilic amine is selected from the group consisting of triethylamine, trimethylamine, tri-n-butylamine, *N*-methylpyrrolidine, *N*-methylpiperidine, diisopropylethylamine, and combinations thereof.~~

~~9. The method of claim 5, wherein the non-nucleophilic amine is triethylamine or diisopropylethylamine~~

~~10. The method of claim 5, wherein the non-nucleophilic amine is added in a quantity sufficient to maintain substantially all of the polyamic acid in solution.~~

~~11. The method of claim 5, wherein a molar ratio of the non-nucleophilic amine to the polyamic acid is from about 2 to about 4, or from about 2.2 to about 2.5.~~

~~12~~6. The method of claim 1, wherein the polyamic acid comprises a tetracarboxylic acid selected from the group consisting of benzene-1,2,4,5-tetracarboxylic acid, [1,1'-biphenyl]-3,3',4,4'-tetracarboxylic acid, 4,4'-oxydiphthalic acid, 4,4'-sulfonyldiphthalic acid, 4,4'-carbonyldiphthalic acid, 4,4'-(propane-2,2-diyl)diphthalic acid, 4,4'-(perfluoropropane-2,2-diyl)diphthalic acid, naphthalene-1,4,5,8-tetracarboxylic acid, 4-(2-(4-(3,4-dicarboxyphenoxy)phenyl)propan-2-yl)phthalic acid, perylene tetracarboxylic acid, and combinations thereof.

~~13~~7. The method of claim 1, wherein the polyamic acid comprises a C2-C6 alkylene diamine, wherein one or more carbon atoms of the C2-C6 alkylene are optionally substituted with one or more alkyl groups.

~~14. The method of claim 13, wherein the C2-C6 alkylene diamine is selected from the group consisting of ethylenediamine, 1,3-diaminopropane, 1,4-diaminobutane, 1,5-diaminopentane, 1,6-diaminohexane, and combinations thereof.~~

~~15~~8. The method of claim 1, wherein the polyamic acid comprises 1,3-phenylenediamine, 1,4-phenylenediamine, 4,4'-methylenedianiline, 4,4'-diaminodiphenyl ether, or a combination thereof.

~~16. The method of claim 15, wherein the polyamic acid comprises a diamine selected from the group consisting of 1,4-phenylenediamine, 4,4'-methylenedianiline, 4,4'-diaminodiphenyl ether, and combinations thereof.~~

~~17. The method of claim 1, wherein a range of concentration of the polyamic acid salt in the solution is from about 0.01 to about 0.3 g/cm$^3$, based on the weight of the polyamic acid.~~

~~18~~9. The method of claim 5, wherein the polyimide gel is in monolithic form, and wherein imidizing the polyamic acid salt comprises adding a dehydrating agent to the aqueous solution of the polyamic acid salt to form a gelation mixture, the method further comprising pouring the gelation mixture into a mold and allowing the gelation mixture to gel.

~~19~~10. The method of claim 5, wherein the polyimide gel is in monolithic form, and wherein imidizing the polyamic acid salt is performed thermally, the method further comprising:

adding delta-gluconolactone to the aqueous solution of the polyamic acid salt to form a gelation mixture;

pouring the gelation mixture into a mold and allowing the gelation mixture to gel;

washing the resulting polyamic acid gel with water; and

thermally imidizing the polyamic acid gel to form the polyimide gel, the thermally imidizing comprising exposing the polyamic acid gel to microwave frequency irradiation.

~~20~~11. The method of claim 5, wherein the polyimide gel is in bead form, and wherein imidizing the polyamic acid salt comprises adding a dehydrating agent to the aqueous solution of the polyamic acid salt to form a gelation mixture; the method further comprising adding the gelation mixture to a solution of a water-soluble acid in water to form the polyimide gel beads, wherein adding comprises dripping the gelation mixture into the solution of the water soluble acid in water, spraying the gelation mixture under pressure through one or more nozzles into the solution of the water-soluble acid in water using pressure; or electrospraying the gelation mixture into the solution of the water soluble acid in water.

~~21. The method of claim 18 or 20, wherein the dehydrating agent is acetic anhydride.~~

~~22. The method of claim 20, wherein the water-soluble acid is a mineral acid or is acetic acid.~~

~~23~~12. The method of claim 5, wherein the polyimide gel is in bead form, and wherein imidizing the polyamic acid salt comprises adding a dehydrating agent to the aqueous solution of the polyamic acid salt to form a gelation mixture, the method further comprising adding the gelation mixture to a water-immiscible solvent, optionally comprising an acid, wherein adding comprises dripping the gelation mixture into the water-immiscible solvent, spraying the gelation mixture under pressure through one or more nozzles into the water-immiscible solvent using pressure; or electrospraying the gelation mixture into the water-immiscible solvent.

~~24. The method of claim 23, wherein the dehydrating agent is acetic anhydride.~~

~~25. The method of claim 23, wherein the optional acid is acetic acid.~~

~~26~~13. The method of claim ~~20~~12, wherein the method comprises electrospraying the gelation mixture through one or more needles at a voltage in a range from about 5 to about 60 kV.

~~27~~14. The method of claim 5, wherein the polyimide gel is in bead form, and wherein imidizing the polyamic acid salt comprises adding a dehydrating agent to the aqueous solution of the polyamic acid salt to form a gelation mixture, the method further comprising combining the gelation mixture with a water-immiscible solvent comprising a surfactant; and mixing the resulting mixture under high-shear conditions.

~~28~~15. The method of claim 5, wherein the polyimide gel is in bead form, and wherein imidizing the polyamic acid salt comprises chemical imidization, the method comprising:

combining the aqueous solution of the polyamic acid salt with a water-immiscible solvent comprising a surfactant;

mixing the resulting mixture under high-shear conditions to form a quasi-stable emulsion; and

adding a dehydrating agent to the quasi-stable emulsion.

~~29. The method of claim 27 or 28, wherein the water-immiscible organic solvent is a C5-C12 hydrocarbon.~~

~~30. The method of claim 27 or 28, wherein the water-immiscible organic solvent is mineral spirits.~~

~~31~~16. The method of claim 1, wherein providing an aqueous solution of a polyamic acid salt comprises:

dissolving a water-soluble diamine in water to form an aqueous diamine solution;

adding a non-nucleophilic amine to the aqueous diamine solution;

adding a tetracarboxylic acid dianhydride to the aqueous diamine solution; and

stirring the resulting solution for a period of time in a range from about 1 hour to about 24 hours at a temperature in a range from about 15 to about 60°C.

~~32~~17. The method of claim 1, wherein providing an aqueous solution of a polyamic acid salt comprises:

dissolving a water-soluble diamine in water to form an aqueous diamine solution;

adding a tetracarboxylic acid dianhydride to the aqueous diamine solution;

stirring the resulting suspension for a period of time in a range from about 1 hour to about 24 hours at a temperature in a range from about 15 to about 60°C;

adding a non-nucleophilic amine to the aqueous diamine solution; and

stirring the resulting suspension for a period of time in a range from about 1 hour to about 24 hours at a temperature in a range from about 15 to about 60°C.

~~33~~18. The method of claim 1, wherein providing an aqueous solution of a polyamic acid salt comprises:

adding to water, simultaneously or in rapid succession, a water-soluble diamine, a tetracarboxylic acid dianhydride, and a non-nucleophilic amine; and

stirring the resulting mixture for a period of time in a range from about 1 hour to about 24 hours at a temperature in a range from about 15 to about 60°C.

~~34. The method of any one of claims 31-33, wherein the non-nucleophilic amine has a solubility of at least about 4 grams per 1 L of water at 20°C.~~

35. The method of claim 34, wherein the non-nucleophilic amine is a tertiary amine.

36. The method of claim 34, wherein the non-nucleophilic amine is selected from the group consisting of triethylamine, trimethylamine, tri-n-butylamine, *N*-methylpyrrolidine, *N*-methylpiperidine, diisopropylethylamine, and combinations thereof.

37. The method of claim 34, wherein the non-nucleophilic amine is triethylamine or diisopropylethylamine.

38. The method of any one of claims 31-33, wherein a molar ratio of the non-nucleophilic amine to the diamine is from about 2 to about 2.5.

39. The method of any one of claims 31-33, wherein the tetracarboxylic acid dianhydride is selected from the group consisting of pyromellitic anhydride (PMDA, biphthalic dianhydride (BPDA), oxydiphthalic dianhydride (ODPA), perylene tetracarboxylic dianhydride, and combinations thereof.

40. The method of any one of claims 31-33, wherein the diamine is a C2-C6 alkylene diamine, wherein one or more carbon atoms of the C2-C6 alkylene are optionally substituted with one or more alkyl groups.

41. The method of claim 40, wherein the C2-C6 alkylene diamine is selected from the group consisting of ethylenediamine, 1,3-diaminopropane, 1,4-diaminobutane, 1,5-diaminopentane, 1,6-diaminohexane, and combination thereof.

42. The method of any one of claims 31-33, wherein the diamine is 1,3-phenylenediamine, 1,4-phenylenediamine, or a combination thereof.

43. The method of claim 42, wherein the diamine is 1,4-phenylenediamine.

~~44. The method of any one of claims 31-33, wherein a molar ratio of the tetracarboxylic acid dianhydride to the diamine is from about 0.9 to about 1.1.~~

~~45~~19. A method of forming a polyamic acid aerogel, the method comprising:

providing an aqueous solution of a polyamic acid salt;

acidifying the polyamic acid salt solution to form a polyamic acid gel; and

drying the polyamic acid gel to form the polyamic acid aerogel.

~~46. The method of claim 45, wherein the polyamic acid gel is in monolithic form, and wherein acidifying the polyamic acid salt comprises adding delta-gluconolactone to the aqueous solution of the polyamic acid salt to form a gelation mixture, pouring the gelation mixture into a mold, and allowing the gelation mixture to gel.~~

~~47. The method of claim 45, wherein the polyamic acid gel is in bead form, and wherein acidifying the polyamic acid salt comprises adding the aqueous solution of polyamic acid salt to a solution of a water-soluble acid in water to form the polyamic acid gel beads, wherein adding comprises dripping the aqueous solution of polyamic acid salt into the solution of the water-soluble acid in water, spraying the aqueous solution of polyamic acid salt under pressure through one or more nozzles into the solution of the water-soluble acid in water using pressure; or electrospraying the aqueous solution of polyamic acid salt into the solution of the water-soluble acid in water.~~

~~48. The method of claim 47, wherein the water-soluble acid is a mineral acid or is acetic acid.~~

~~49. The method of claim 47, wherein the method comprises electrospraying the aqueous solution of polyamic acid salt through one or more needles at a voltage in a range from about 5 to about 60 kV.~~

~~50. The method of claim 45, wherein the polyamic acid gel is in microbead form, the method further comprising:~~

~~combining the aqueous solution of polyamic acid salt with a water-immiscible solvent comprising a surfactant;~~

~~mixing the resulting mixture under high-shear conditions to form an emulsion; and~~

~~adding an organic acid to the emulsion.~~

~~51. The method of claim 50, wherein the water-immiscible organic solvent is a C5-C12 hydrocarbon.~~

~~52. The method of claim 50, wherein the water-immiscible organic solvent is mineral spirits.~~

~~53. The method of claim 50, wherein the organic acid is acetic acid.~~

~~54. The method of claim 45, wherein providing the aqueous solution of the polyamic acid salt comprises:~~

~~providing a polyamic acid in substantially pure form;~~

~~adding the polyamic acid to water to form an aqueous suspension of the polyamic acid;~~

~~adding a base to the aqueous suspension of the polyamic acid to form the aqueous solution of the polyamic acid salt.~~

~~55. The method of claim 54, wherein the base is a non-nucleophilic amine.~~

56. The method of claim 54, wherein the non-nucleophilic amine has a solubility of at least about 4 grams per 1 L of water at 20°C.

57. The method of claim 55, wherein the non-nucleophilic amine is a tertiary amine.

58. The method of claim 55, wherein the non-nucleophilic amine is selected from the group consisting of triethylamine, trimethylamine, tri-n-butylamine, N-methylpyrrolidine, N-methylpiperidine, diisopropylethylamine, and combinations thereof.

59. The method of claim 58, wherein the non-nucleophilic amine is triethylamine or diisopropylethylamine.

60. The method of claim 55, wherein the non-nucleophilic amine is added in a quantity sufficient to maintain substantially all of the polyamic acid in solution.

61. The method of claim 55, wherein a molar ratio of the non-nucleophilic amine to the polyamic acid is from about 2 to about 4, or from about 2.2 to about 2.5.

62. The method of claim 55, wherein the polyamic acid comprises a tetracarboxylic acid selected from the group consisting of benzene-1,2,4,5-tetracarboxylic acid, [1,1'-biphenyl]-3,3',4,4'-tetracarboxylic acid, 4,4'-oxydiphthalic acid, 4,4'-sulfonyldiphthalic acid, 4,4'-carbonyldiphthalic acid, 4,4'-(propane-2,2-diyl)diphthalic acid, 4,4'-(perfluoropropane-2,2-diyl)diphthalic acid, naphthalene-1,4,5,8-tetracarboxylic acid, 4-(2-(4-(3,4-dicarboxyphenoxy)phenyl)propan-2-yl)phthalic acid, perylene tetracarboxylic acid, and combinations thereof.

63. The method of claim 55, wherein the polyamic acid comprises a C2-C6 alkylene diamine, and wherein one or more carbon atoms of the C2-C6 alkylene are optionally substituted with one or more alkyl groups.

64. The method of claim 63, wherein the C2-C6 alkylene diamine is selected from the group consisting of ethylenediamine, 1,3-diaminopropane, 1,4-diaminobutane, 1,5-diaminopentane, 1,6-diaminohexane, and combinations thereof.

65. The method of claim 55, wherein the polyamic acid comprises 1,3-phenylenediamine, 1,4-phenylenediamine, 4,4'-methylenedianiline, 4,4'-diaminodiphenyl ether, or a combination thereof.

66. The method of claim 65, wherein the polyamic acid comprises a diamine selected from the group consisting of 1,4-phenylenediamine, 4,4'-methylenedianiline, 4,4'-diaminodiphenyl ether, and combinations thereof.

67. The method of claim 55, wherein a range of concentration of the polyamic acid salt in the solution is from about 0.01 to about 0.3 $g/cm^3$, based on the weight of the polyamic acid.

68. The method of claim 45, wherein providing an aqueous solution of a polyamic acid salt comprises:

dissolving a water-soluble diamine in water to form an aqueous diamine solution;

adding a non-nucleophilic amine to the aqueous diamine solution;

adding a tetracarboxylic acid dianhydride to the aqueous diamine solution; and

stirring the resulting mixture for a period of time in a range from about 1 hour to about 24 hours at a temperature in a range from about 15 to about 60°C.

69. The method of claim 45[, wherein providing an aqueous solution of a polyamic acid salt comprises:

dissolving a water-soluble diamine in water to form an aqueous diamine solution;

adding a tetracarboxylic acid dianhydride to the aqueous diamine solution;

stirring the resulting suspension for a period of time in a range from about 1 hour to about 24 hours at a temperature in a range from about 15 to about 60°C.

adding a non-nucleophilic amine to the suspension;

stirring the resulting mixture for a period of time in a range from about 1 hour to about 24 hours at a temperature in a range from about 15 to about 60°C.

70. The method of claim 45, wherein providing an aqueous solution of a polyamic acid salt comprises:

adding to water, simultaneously or in rapid succession, a water-soluble diamine, a tetracarboxylic acid dianhydride, and a non-nucleophilic amine; and

stirring the resulting mixture for a period of time in a range from about 1 hour to about 24 hours at a temperature in a range from about 15 to about 60°C.

71. The method of any one of claims 68-70, wherein the non-nucleophilic amine has a solubility of at least about 4 grams per 1 L of water at 20°C.

72. The method of claim 71, wherein the non-nucleophilic amine is a tertiary amine.

73. The method of claim 72, wherein the non-nucleophilic amine is selected from the group consisting of triethylamine, trimethylamine, tri-n-butylamine, N-methylpyrrolidine, N-methylpiperidine, and diisopropylethylamine.

74. The method of claim 73, wherein the non-nucleophilic amine is triethylamine or diisopropylethylamine

75. The method of claim 71, wherein a molar ratio of the non-nucleophilic amine to the diamine is from about 2 to about 2.5.

~~76. The method of any one of claims 68-70, wherein the tetracarboxylic acid dianhydride is selected from the group consisting of pyromellitic anhydride (PMDA, biphthalic dianhydride (BPDA), oxydiphthalic dianhydride (ODPA), perylene tetracarboxylic dianhydride, and combinations thereof.~~

~~77. The method of any one of claims 68-70, wherein the diamine is a C2-C6 alkylene diamine, and wherein one or more carbon atoms of the C2-C6 alkylene are optionally substituted with one or more alkyl groups.~~

~~78. The method of claim 77, wherein the C2-C6 alkylene diamine is selected from the group consisting of ethylenediamine, 1,3-diaminopropane, 1,4-diaminobutane, 1,5-diaminopentane, 1,6-diaminohexane, and combination thereof.~~

~~79. The method of any one of claims 68-70, wherein the diamine is 1,4-phenylenediamine.~~

~~80. The method of any one of claims 68-70, wherein a molar ratio of the tetracarboxylic acid dianhydride to the diamine is from about 0.9 to about 1.1.~~

~~81~~20. A method of forming a polyamic acid metal salt aerogel in the form of beads, the method comprising:

providing an aqueous solution of an ammonium or alkali metal salt of a polyamic acid;

performing a metal ion exchange comprising adding the solution of the polyamic acid salt to a solution comprising a soluble metal salt to form polyamate metal salt gel beads; and

drying the polyamic acid metal salt gel beads to form the polyamic acid metal salt aerogel beads.

82. The method of claim 81, wherein the soluble metal salt comprises a main group transition metal, a rare earth metal, an alkaline earth metal, or a combination thereof.

83. The method of claim 82, wherein the soluble metal salt comprises copper, iron, nickel, silver, calcium, magnesium, or a combination thereof.

84. The method of claim 82, wherein the soluble metal salt comprises lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, or a combination thereof.

85. The method of claim 81, wherein adding the polyamic acid salt solution to a solution comprising a soluble metal salt comprises dripping the aqueous solution of polyamic acid salt into the solution of the soluble metal salt, spraying the aqueous solution of polyamic acid salt under pressure through one or more nozzles into the solution of the soluble metal salt, or electrospraying the aqueous solution of polyamic acid salt into the solution of the soluble metal salt.

86. The method of claim 85, wherein the method comprises electrospraying the polyamic acid salt solution through one or more needles at a voltage in a range from about 5 to about 60 kV.

87. The method of claim 1, wherein drying the polyimide gel comprises:

optionally, washing or solvent exchanging the polyimide gel; and

subjecting the polyimide gel to elevated temperature conditions, lyophilizing the polyimide gel, or contacting the polyimide gel with supercritical fluid carbon dioxide.

~~88. The method of claim 87, wherein the washing or solvent exchanging is performed with water, a C1 to C3 alcohol, acetone, acetonitrile, ether, tetrahydrofuran, toluene, liquid carbon dioxide, or a combination thereof.~~

~~89~~21. The method ~~87~~of any one of claims 1, 19, or 20, further comprising converting the polyimide aerogel to an isomorphic carbon aerogel, the converting comprising pyrolyzing the polyimide aerogel under inert atmosphere at a temperature of at least about 650°C.

~~90. The method of claim 45, wherein drying the polyamic acid gel comprises:~~

~~optionally, washing or solvent exchanging the polyamic acid gel; and~~

~~subjecting the polyamic acid gel to elevated temperature conditions, lyophilizing the polyamic acid gel, or contacting the polyamic acid gel with supercritical fluid carbon dioxide.~~

~~91. The method of claim 90, wherein the washing or solvent exchanging is performed with water, a C1 to C3 alcohol, acetone, acetonitrile, ether, tetrahydrofuran, toluene, liquid carbon dioxide., or a combination thereof~~

~~92. The method of claim 90, further comprising converting the polyamic acid aerogel to an isomorphic carbon aerogel, the converting comprising pyrolyzing the polyamic acid aerogel material under inert atmosphere at a temperature of at least about 650°C.~~

~~93. The method of claim 92, further comprising converting the polyamic acid aerogel to an isomorphic polyimide aerogel before the pyrolyzing, wherein converting the polyamic acid aerogel to a polyimide aerogel comprises thermally imidizing the polyamic acid aerogel.~~

~~94. The method of claim 81, wherein drying the polyamic acid gel comprises:~~

~~optionally, washing or solvent exchanging the polyamic acid gel; and~~

~~subjecting the polyamic acid gel to elevated temperature conditions, lyophilizing the polyamic acid gel, or contacting the polyamic acid gel with supercritical fluid carbon dioxide.~~

~~95. The method of claim 94, wherein the washing or solvent exchanging is performed with water, a C1 to C3 alcohol, acetone, acetonitrile, ether, tetrahydrofuran, toluene, liquid carbon dioxide., or a combination thereof~~

~~96. The method of claim 94, further comprising converting the polyamic acid aerogel to an isomorphic carbon aerogel, the converting comprising pyrolyzing the polyamic acid aerogel material under inert atmosphere at a temperature of at least about 650°C.~~

~~97. The method of claim 81, further comprising converting the polyamic acid metal salt aerogel to an isomorphic metal- or metal oxide-doped carbon aerogel, the converting comprising pyrolyzing the polyamic acid aerogel under inert atmosphere at a temperature of at least about 650°C.~~

~~98~~22. The method of any one of claims 1, 19, or 20, further comprising adding an electroactive material to the aqueous solution of the polyamic acid salt.

~~99. The method of claim 45, further comprising adding an electroactive material to the aqueous solution of the polyamic acid salt.~~

~~100. The method of claim 81, further comprising adding an electroactive material to the aqueous solution of the polyamic acid ammonium or alkali metal salt.~~

~~101. The method of claim 89, wherein the carbon aerogel has properties substantially similar to those of a carbon aerogel prepared by pyrolyzing a corresponding polyimide aerogel that has been prepared by a conventional non-aqueous method.~~

~~102. The method of claim 92 or 96, wherein the carbon aerogel has properties substantially similar to those of a carbon aerogel prepared by pyrolyzing a corresponding polyimide aerogel that has been prepared by a conventional non-aqueous method.~~

~~103. (New) The method of claim 97, wherein the metal- or metal oxide-doped carbon aerogel has properties substantially similar to those of a metal- or metal oxide-doped carbon aerogel prepared by pyrolyzing a corresponding metal- or metal oxide-doped polyimide aerogel that has been prepared by a conventional non-aqueous method.~~

~~104~~23. The method of any one of claims 1, 19, or 20, wherein the polyimide gel contains residual water in an amount greater than about 75% by volume.

~~105. The method of claim 45, wherein the polyamic acid gel contains residual water in an amount greater than about 75% by volume.~~

~~106. The method of claim 81, wherein the polyamic acid metal salt gel beads contain residual water in an amount greater than about 75% by volume.~~

~~107~~24. A polyimide aerogel prepared by the method of any one of claims 1, 19, or 20.

~~108. The polyimide aerogel of claim 107, comprising terminal amine groups as determined by solid state $^{15}$N-NMR.~~

~~109. A polyamic acid aerogel prepared by the method of claim 45.~~

~~110. The polyamic acid aerogel of claim 109, comprising terminal amine groups as determined by solid state $^{15}$N-NMR.~~

~~111. A polyamic acid metal salt aerogel prepared by the method of claim 81.~~

~~112. The polyamic acid aerogel of claim 111, comprising terminal amine groups as determined by solid state $^{15}$N-NMR.~~

~~113~~25. A carbon aerogel prepared by the method of ~~any one of~~ claim~~s 89, 92, 96, or 97~~21.

~~114~~26. A carbon aerogel comprising an electroactive material prepared by the method of any one of claims ~~98-100~~22.