CLAIMS

1. A method of making an anion exchange membrane, comprising:

mixing a tertiary amine monomer with a quaternization agent to produce a quaternary amine monomer;

mixing a cross-linking agent and a solvent with the functional monomer to form a monomeric solution; and

casting the monomeric solution on a polymeric microporous substrate to form the anion exchange membrane.

2. The method of claim 1, wherein the tertiary amine monomer is selected from the group consisting of 1-vinylimidazole, 2-methyl-1-vinylimidazole, 9-vinylcarbazole, N-ethyl-2-vinylcarbazole, 2-vinylpyridine, 3-vinylpyridine, 4-vinylpyridine, and mixtures thereof.

3. The method of claim 2, wherein the quaternization agent is selected from the group consisting of benzyl chloride, benzyl bromide, benzyl iodide, p-dichlorobenzene, m-dichlorobenzene, 1,4-dichloro-2-nitrobenzene, 3-(Benzyloxy)benzyl chloride, 4-(Benzyloxy)benzyl chloride, 2-(Trifluoromethyl)-benzyl chloride, 3-(Trifluoromethyl)benzyl chloride, 4-(Trifluoromethyl)benzyl chloride, 1-chlorohexane, 1-chloropentane, 1-chlorobutane, 1-chloropropane, 1,6 dichlorohexane, 1,5-dichloropentane, 1,4-dichlorobutane, 1,3-dichloropropane, 1-bromohexane, 1-bromopentane, 1-bromobutane, 1-bromopropane, 1,6- dibromohexane, 1,5-dibromopentane, 1,4-dibromobutane, 1,3-dibromopropane, 1-iodohexane, 1-iodopentane, 1-iodobutane, 1-iodoopropane, 1-iodideethane, 1-iodidemethane,1,6-diiodohexane, 1,5-diiodorpentane, 1,4-diiodobutane,1,3-diiodopropane, and mixtures thereof.

4. The method of claim 3, wherein the cross-linking agent is selected from the group consisting of vinylbenzyl chloride, m-divinylbenzene, ethyleneglycol-dimethacrylate, p-dichlorobenzene, m-dichlorobenzene, 1,4-dichloro-2-nitrobenzene, 1,6 dichlorohexane, 1,5-dichloropentane, 1,4-dichlorobutane, 1,3-dichloropropane, 1,6- dibromohexane, 1,5-dibromopentane, 1,4-dibromobutane, 1,3-dibromopropane, 1,6- dibromohexane, 1,5-dibromopentane, 1,4-dibromobutane, 1,3-dibromopropane, 1,4-butanediol dimethacrylate, 1,4-butanediol diacrylate, 1,6-hexanediol diacrylate, Pentaerythritol triacrylate, divinyl benzene, (m- and p-mixture), trimethylolpropane triacrylate, trimethylolpropane

trimethacrylate, ethoxylated (n) bisphenol A di(meth)acrylate (n=1.5, 2, 4, 6, 10, 30), ethoxylated (n) trimethylolpropanetri(meth)Acrylate (n= 3,6,9,10,15,20), propoxylated(n) trimethylolpropane triacrylate (n =3,6), and mixtures thereof.

5. The method of claim 4, wherein the solvent is selected from the group consisting of dipropyleneglycol, n-propanol, 2-propanol, 1-methyl-2-pyrrolidinone, 1-butanol, and mixtures thereof.

6. The method of claim 5, further comprising mixing a polymerization initiator with the monomer solution.

7. The method of claim 6, wherein the polymerization initiator is selected from the group consisting of organic peroxides, 2,2'-azobis[2,[2-imdazolin-2-yl]-propane] dihydrochloride, α,α'-azoisobutyronitrile, 2,2'-azobis[2-methylpropioaminidine] dihydrochloride, 2,2'-azobis [2, [2-imdazolin-2-yl]-propane], dimethyl 2,2'-azobis[2-methylpropionate] and benzoyl peroxide.

8. The method of claim 7, further comprising controlling polymerization with an inhibitor.

9. The method of claim 8, wherein the polymerization inhibitor is selected from the group consisting of 4-methoxyphenol and 4-tert-butyl catechol.

10. The method of claim 9, wherein the polymeric microporous substrate comprises at least one polymeric material selected from the group consisting of polypropylene, high molecular weight polyethylene, ultrahigh molecular weight polyethylene, polyvinyl chloride, polyvinylidene difluoride, and polytetrafluoroethylene.

11. The method of claim 10, wherein casting comprises applying heat at a temperature of about 0°C to about 100°C, ultraviolet light at a wavelength of about 100 nm to about 400 nm, or ionizing radiation.