WHAT IS CLAIMED IS:

1. A monomer comprising:

a poly(alkylene) oxide backbone having 20 to 1000 carbon atoms and 10 to 500 oxygen atoms, the carbon/oxygen ratio being 1:1 to 10:1;

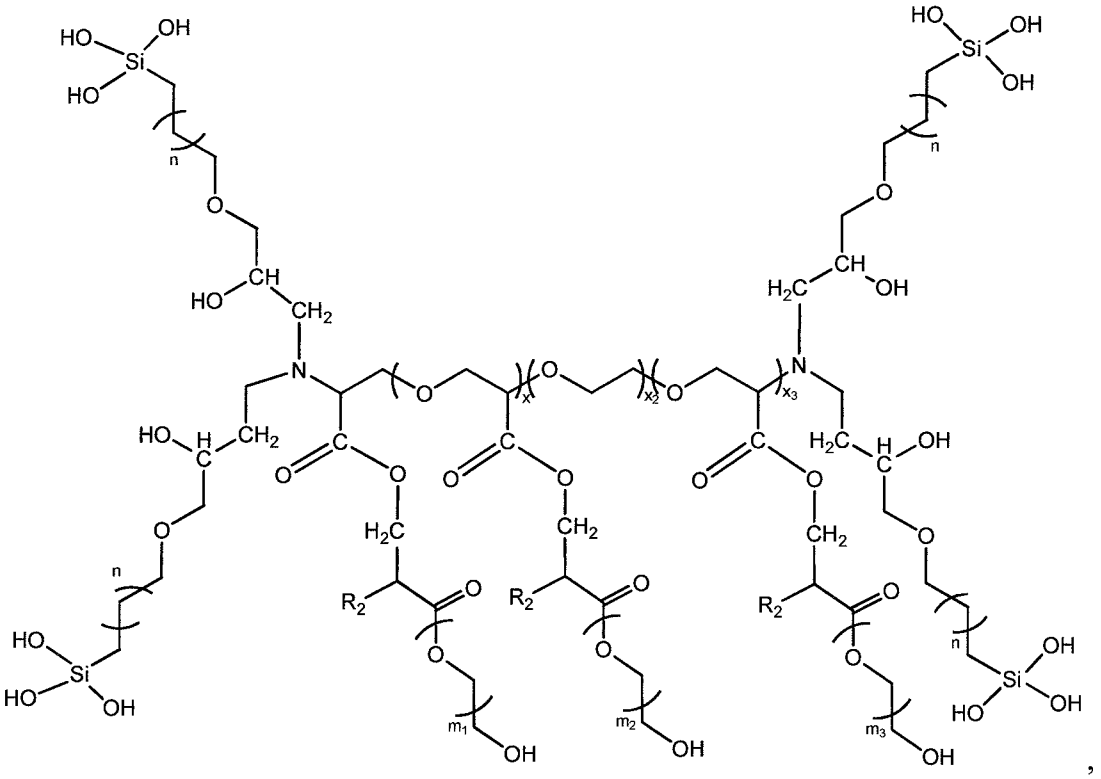
one to one hundred poly(alkylene) oxide side chains attached to the backbone, wherein each chain has 10 to 500 carbon atoms and 5 to 250 oxygen atoms, the carbon/oxygen ratio being 1:1 to 10:1; and

one to eight cross-linking groups also attached to the backbone, each cross linking group having two to four binding moieties,

whereby the monomer is capable of cross-linking other monomers having the same structural features to form a polymer via its binding moieties and the binding moieties of the other monomers.

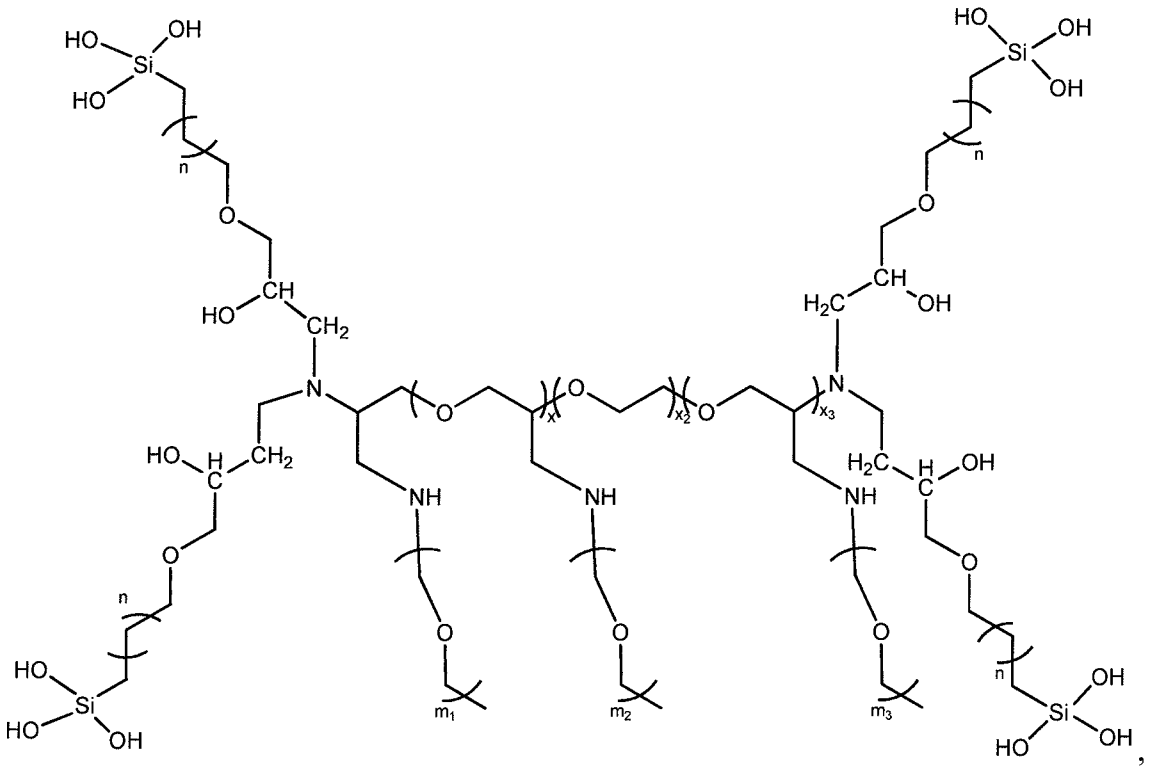
2. The monomer of claim 1, wherein one to three cross linking groups attach to each end of the backbone.

3. The monomer of claim 2, wherein the monomer is of the formula:



wherein each of m_1, m_2, and m_3, independently, is 5 to 500; each n, independently, is 1 to 20; each of x, x_2, and x_3, independently, is 2 to 500; and R_2 is a hydrogen or an alkyl group.

4. The monomer of claim 2, wherein the monomer is of the formula:



wherein each of m_1, m_2, and m_3, independently, is 5 to 500; each n, independently, is 1 to 10; and each of x, x_2, and x_3, independently, is 2 to 500.

5. A polymer comprising a plurality of monomers that are cross-linked to each other, wherein each of the monomers, independently, is a monomer of claim 1.

6. The polymer of claim 5, wherein each of the monomers, independently, is a monomer of claim 3.

7. The polymer of claim 5, wherein each of the monomers, independently, is a monomer of claim 4.

~~8. A method of preparing a branched cross-linker-containing poly(alkylene) oxide chain, the method comprising reacting a branched poly(alkylene) oxide backbone, having a first reactive group and a second reactive group on the backbone, with two-to-eight cross-~~

~~linkers, each having a third reactive group, whereby the third reactive group of a cross linker covalently bonds with the first reactive group and the third reactive group of another cross linker covalently bonds with the second reactive group to form a branched cross linker-containing poly(alkylene) oxide chain, wherein each of the cross linkers has two to four binding moieties~~

~~9.~~8. A method of preparing a branched cross linker-containing poly(alkylene) oxide chain, the method comprising:

reacting a poly(alkylene) oxide backbone, having a first reactive group and a second reactive group, with two to eight cross linkers, each having

a third reactive, whereby the third reactive group of a cross linker covalently bonds with the first reactive group and the third reactive group of another cross linker covalently bonds with the second reactive group to form a cross linker-containing poly(alkylene) oxide backbone; wherein each of the cross linkers has two to four binding moieties; and

generating free radicals on the cross linker-containing poly(alkylene) oxide backbone and reacting poly(alkylene) oxide side chains, each having a fourth reactive group at one end, with the cross linker-containing poly(alkylene) oxide backbone to form a branched cross linker-containing poly(alkylene) oxide chain, via covalent bonding of the fourth reactive group to the cross linker-containing poly(alkylene) oxide backbone.

~~10.~~9. A method of preparing a polymer, the method comprising reacting a plurality of branched cross linker-containing poly(alkylene) oxide chains, prepared by the method of claim 8 ~~or claim 9~~, to form a polymer via bonding between binding moieties in one chain to binding moieties in other chains.

~~11.~~10. A method of altering the composition of a gaseous mixture, the method comprising:

providing a membrane formed of the polymer of claim 5, and

passing through the membrane a gaseous mixture, containing at least a first gas and at least a second gas, wherein the first gas is selected from the group containing H_2, N_2, CH_4, O_2, and C_3H_8, and the second gas is selected from the group containing CO_2, H_2S, CO, and H_2O.

~~12.~~11. The method of claim ~~11~~10, wherein the first gas is H_2 and the second gas is CO_2.

~~13.~~12. A method of preparing a membrane, the method comprising:

preparing a solution containing poly(alkylene) oxide backbones, poly(alkylene) oxide chains, and a solvent, the backbones and the chains being dispersed in the solvent, wherein each of the backbones has two to eight cross linking groups and each of the cross linking groups has two to four binding moieties;

providing a layer of the solution;

cross linking the backbones via covalent bonding between binding moieties in one backbone to binding moieties in other backbones; and

removing the solvent to form a membrane;

whereby the chains are blended with the cross linked backbones.

~~14.~~13. A method of preparing a membrane, the method comprising:

preparing a solution containing poly(alkylene) oxide backbones, poly(alkylene) oxide chains, the backbones and the side chains being dispersed in the solvent, wherein each of the backbones has two to eight cross linking groups, each of cross linking groups has two to four binding moieties and each of the chains has a reactive group at an end;

providing a layer of the solution;

cross linking the backbones via covalent bonding between binding moieties in one backbone to binding moieties in other backbones;

removing the solvent to obtain the membrane; and

generating free radicals on the poly(alkylene) oxide backbones, whereby the chains, via the reactive groups, covalently bond to the backbones.

~~15.~~14. A membrane prepared by the method of claim ~~13~~ 12.

~~16.~~15. A membrane prepared by the method of claim ~~14~~ 13.

~~17.~~16. A method of altering the composition of a gaseous mixture, the method comprising passing a gaseous mixture through the membrane of claim ~~13~~ 12 or ~~14~~ 13, wherein the mixture contains at least a first gas is selected from the group containing H_2, N_2, CH_4, O_2, and C_3H_8, and the second gas is selected from the group containing CO_2, H_2S, CO, and H_2O.

~~18.~~17. The method of claim ~~17~~ 16, wherein the first gas is H_2 and the second gas is CO_2.