CLAIMS

1. A composition comprising:

a polymer formed from at least one monomer containing at least one silicone group and at least one zwitterionic group;

wherein the composition also includes at least one hydrophilic monomer; and

wherein the composition contains between 0.1-9 wt% of the at least one monomer containing at least one silicone group and at least one zwitterionic group.

2. The composition according to claim 1, wherein the at least one monomer has a single zwitterionic group.

3. The composition according to claim 1 or 2, wherein the zwitterionic group comprises one of a phosphorylcholine, alkyl carbobetaine, alkylamide carbobetaine, alkyl sulfobetaine, alkylhydroxy sulfobetaine, alkylamide sulfobetaine, alkylamidehydroxy sulfobetaine and thereof.

4. The composition according to claim 1 or 2, wherein the at least one hydrophilic monomer comprises one or more of glyceryl methacrylate, (hydroxyethyl)methacrylate, ethylene glycol dimethacrylate, methacrylic acid, acrylamide, N,N-dimethylacrylamide, N,N-diethylacrylamide, N,N-diisopropylacrylamide, N,N-dimethylacetamide, N-vinylpyrrolidinone, or a combination of any of the foregoing.

5. The composition according to claim 4, wherein the at least one hydrophilic monomer also contains a salt of methacrylic acid.

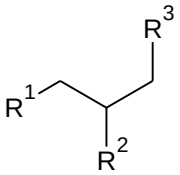
6. The composition according to any one of claims 1 to 5, wherein the relaxation rate of the composition is less than 5.5%.

7. The composition according to claim 6, wherein the relaxation rate is less than 4.0%.

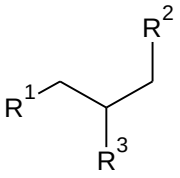
8. The composition according to any one of claims 1 to 5, wherein the dynamic friction of the composition comprises less than 50 mN.

9. The composition according to claim 8, wherein the dynamic friction comprises less than 40 mN.

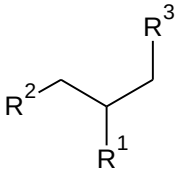
10. The composition according to any one of claims 1 to 9, wherein the at least one monomer comprises isomers conforming to formulae (Ia) to (Ic):



(Ia)



(Ib)



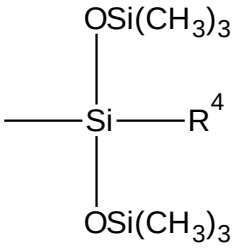
(Ic)

wherein:

R^1 is a group containing a polymerizable moiety comprising, but not limited to, methacryloyl, acryloyl, styryl, or allyl;

R^2 is a group containing a C1-C15 alkenyl group terminated in a silicone moiety of structure (II), where R^4 is either $-CH_3$ or $-[-Si(CH_3)_2-O-]_n-Si(CH_3)_3$ where n=0-50;

R^3 is a zwitterionic group, including, but not limited to phosphorylcholine, betaine, sulfobetaine, or amphoacetate.



(II)

11. The composition according to claim 10, wherein the composition includes between 0 and 10 wt% of a non-silicone monomer containing phosphorylcholine.

12. An ophthalmic lens, comprising:

a body formed from the polymer of claim 1, the body including:

a front surface configured to face away from a wearer;

a back surface configured to contact an eye of the wearer; and

a greater amount of the at least one monomer containing at least one silicone group and at least one zwitterionic group at the front surface than at a point in the body between the front surface and the back surface.

13. The ophthalmic lens of claim 12, wherein:

the polymer is formed from a monomer mix wherein the weight percentage of the content of the at least one monomer containing at least one silicone group and at least one zwitterionic group to the at least one hydrophilic monomer is 0.1-9 wt%; and

the at least one hydrophilic monomer further comprises a methacrylate salt.

14. The ophthalmic lens of claim 13, wherein the relaxation rate is less than 5.5%.

15. The ophthalmic lens of claim 13, wherein the dynamic friction comprises less than 50 mN.

16. The ophthalmic lens of claim 13, wherein:

the at least one monomer containing at least one silicone group and at least one zwitterionic group comprises one of SiGMA-PC or SiMA-PC;

the at least one hydrophilic monomer comprises a plurality of hydrophilic monomers; and

the polymer further comprises sodium methacrylate.

17. The ophthalmic lens of claim 16, wherein the polymer is also formed from at least one monomer selected from the group consisting of glyceryl methacrylate, (hydroxyethyl)methacrylate, ethylene glycol dimethacrylate, methacrylic acid, acrylamide, N,N-dimethylacrylamide, N,N-diethylacrylamide, N,N-diisopropylacrylamide, N,N-dimethylacetamide, N-vinylpyrrolidinone, or a combination of any of the foregoing.

18. The ophthalmic lens of claim 17, wherein the SiGMA-PC monomer is about 0.5 to about 15 weight percent (wt%) of the polymer, glyceryl methacrylate is about 10 wt% to about 50 wt% of the polymer, and the 2-hydroxyethyl methacrylate is about 20 wt% to about 80 wt% of the polymer.

19. The ophthalmic lens of claim 16, wherein:

the body has a larger concentration of SiGMA-PC or SiMA-PC at the front surface than at the back surface;

the lens includes an oxygen transmissibility value (Dk/thickness) greater than 20; and

the lens exhibits a Young's modulus of about 0.1 MPa to about 0.5 MPa.

20. A method of making a contact lens, comprising:

applying a liquid lens material into a mold; and

curing the liquid lens material in the mold;

wherein the liquid lens material includes a plurality of monomers, the plurality of monomers including at least some 3,5,8,13–tetraoxa-4-phospha-12,14-disilapentadecan-1-aminium,4-hydroxy-N,N,N,12,14,14-hexamethyl-6-[[(2-methyl-1-oxo-2-propen-1-yl)oxy]methyl]-12-[(trimethylsilyl)oxy]-,inner salt,4-oxide ("SiGMA-PC") monomer units.

21. The method of claim 20, wherein the mold comprises a spin-cast mold; and
curing the liquid lens material comprises spinning the liquid lens material while at least partially curing the liquid lens material.

22. The method of claim 20, wherein the mold comprises a cast mold.

23. The method of claim 21 or 22 wherein at least one mold surface is treated so as to modify its surface energy.