CLAIMS

What Is Claimed Is:

1. A block copolymer of A-B-A type comprising the reaction product of a poly(farnesene) diol and a cyclic lactone or cyclic ether, wherein the poly(farnesene) diol is present in the range of from about 10 wt% to about 95 wt% (e.g., about 10 wt% to about 90 wt%) of the total molecular weight of the copolymer, and wherein the cyclic lactone or cyclic ether is present in the range of from about 5 wt% to about 90 wt% (e.g., about 10 wt% to about 90 wt%) of the total molecular weight of the copolymer, the copolymer having an average molecular weight of from about 1000 g/mol to about 10,000 g/mol.
2. The copolymer of claim 1, wherein

   the poly(farnesene) diol is a polymer comprising at least one monomer selected from (*E*,*E*)-α-farnesene, (*Z*,*E*)-α-farnesene, (*Z*,*Z*)-α-farnesene, *cis*-β-farnesene, *trans*-β-farnesene, a hydrogenated derivative thereof, and combinations thereof; and/or

   the cyclic lactone is at least one of α-acetolactone, β-propiolactone, γ-butyrolactone, δ-valerolactone, ε-caprolactone, lactide, glycolide or a combination thereof, or the cyclic ether is at least one of ethylene oxide, propylene oxide, 1,2-butylene oxide, 2,3-butylene oxide, tetrahydrofuran, methyltetrahydrofuran or a combination thereof.
3. The copolymer of claim 1, wherein the cyclic lactone is ε-caprolactone.
4. The copolymer of claim 1, wherein the poly(farnesene) diol is present in the range of from about 10 wt% to about 60 wt% of the total molecular weight of the block copolymer.
5. A polymeric composition comprising a reaction product of the copolymer of claim 1 and at least one of a diacid, a diisocyanate, urea, dinitrile or a combination thereof, thereby forming a polyester, polyurethane, polyurethane-urea, polyamide or polyamide material.
6. A polymeric composition comprising as the reaction product of:
   a) at least one block copolymer of A-B-A type, having an average molecular weight of 1000 to 10,000 g/mol, the at least one block copolymer being the reaction product of a poly(farnesene) diol and a cyclic lactone or cyclic ether, wherein the poly(farnesene) diol is present in the range of from about 10 wt% to about 95 wt% (e.g., about 10 wt% to about 90 wt%) of the total molecular weight of the at

least one block copolymer, and the cyclic lactone or cyclic ether is present in the range of from about 5 wt% to about 95 wt% (e.g., about 10 wt% to about 90 wt%) of the total molecular weight of the at least one block copolymer;

b) at least one diisocyanate; and

c) optionally a diol or diamine chain extender having a molecular weight of from about 60 g/mol to about 600 g/mol, with an NCO:OH molar ratio of from about 0.9:1 to about 2:1.

7. The polymeric composition of claim 6, wherein

the poly(farnesene) diol is a polymer comprising at least one monomer selected from (*E*,*E*)-α-farnesene, (*Z*,*E*)-α-farnesene, (*Z*,*Z*)-α-farnesene, *cis*-β-farnesene, *trans*-β-farnesene, a hydrogenated derivative thereof, and combinations thereof; and/or

the cyclic lactone is at least one of α-acetolactone, β-propiolactone, γ-butyrolactone, δ-valerolactone, ε-caprolactone, lactide, glycolide or a combination thereof, or the cyclic ether is at least one of ethylene oxide, propylene oxide, 1,2-butylene oxide, 2,3-butylene oxide, tetrahydrofuran, methyltetrahydrofuran or a combination thereof.

8. The polymeric composition of claim 6, wherein the cyclic lactone is ε-caprolactone.

9. The polymeric composition of claim 6, wherein

poly(farnesene) diol is present in the range of from about 10 wt% to about 60 wt% of the total molecular weight of the at least one block copolymer; or

the at least one block copolymer comprises in the range of from about 25 wt% to about 95 wt% of the polymer composition, and wherein the polymer composition is a polyurethane or polyurethane-urea.

10. The polymeric composition of claim 6, wherein

the polymeric composition has a Shore Hardness of between about 25 Shore A and about 60 Shore D; or

the polymeric composition is at least one of a thermoplastic polyurethane, hot cast elastomer, cold cast elastomer, microcellular polyurethane foam, polyurethane dispersion in aqueous or organic media, polyurethane adhesive, 1- or 2-component polyurethane coating, additive manufacturing material or polyurethane sealant.

11. The polymeric composition of claim 6, wherein

the diisocyanate is selected from a group consisting of 4,4'-diphenylmethanediisocyanate, isophorone diisocyanate, 1,6-hexamethylene diisocyanate, 1,5-napthylene diisocyanate, 4,4'-dicyclohexylmethane diisocyanate, and combinations thereof; and/or

the diol chain extender is selected from a group consisting of ethylene glycol, 1,4-butanediol, 1,6-hexanediol, 1,4-di-(betahydroxyethyl)-hydroxyquinone, 1,4-cyclohexanedimethanol, 1,4-di-(betahydroxyethyl)-bisphenol A, and combinations thereof, or the diamine chain extender is selected from a group consisting of 4,4'-diaminodiphenylmethane, 3,3'-dichloro-4,4'-diaminodiphenylmethane, 1,4-diaminobenzene, 3,3'-dimethoxy-4,4-diamino biphenyl, 3,3'-dimethyl-4,4-diamino biphenyl, 4,4'-diamino biphenyl, 3,3'-dichloro-4,4'-diamino biphenyl, and combinations thereof.

12. A co-polyamide-polyester composition, produced as the reaction product of:
    a) at least one block copolymer of A-B-A type having an average molecular weight of from about 1000 g/mol to about 10,000 g/mol, wherein the copolymer is the reaction product of a poly(farnesene) diol and a cyclic lactone or cyclic ether, and wherein the poly(farnesene) diol is present in the range of from about 10 wt% to about 95 wt% (e.g., about 10 wt% to about 90 wt%) of the total molecular weight of the at least one block copolymer, and the cyclic lactone or cyclic ether is present in the range of from about 5 wt% to about 90 wt% (e.g., about 10 wt% to about 90 wt%) of the total molecular weight of the at least one block copolymer; and
    b) at least one polyamide of an oligomer of structure D-(E-D)x or Fy-D-Fz where D is an alpha – omega diacid, E is a alpha – omega diamine and F is a lactam or/and alpha amine omega acid, and x, y, and z are an integer equal to or greater than 1.
13. The co-polyamide-polyester composition of claim 12, wherein D, E and F are independently selected from a C2-C12 aliphatic or aromatic group.
14. The co-polyamide-polyester composition of claim 13, wherein the co-polyamide-polyester composition is of the structure Fy-D-Fz, wherein F is a C11, D is a C12 and y and z are an integer between 1 and 5.
15. A co-polyester composition, produced as the reaction product of:

a) at least one block copolymer of A-B-A type, having an average molecular weight of from about 1000 g/mol to about 10,000 g/mol, wherein the copolymer is the reaction product of a poly(farnesene) diol and a cyclic lactone or cyclic ether, and wherein the poly(farnesene) diol is present in the range of from about 10 wt% to about 95 wt% (e.g., about 10 wt% to about 90 wt%) of the total molecular weight of the at least one block copolymer, and the cyclic lactone or cyclic ether is present in the range of from about 5 wt% to about 90 wt% (e.g., about 10 wt% to about 90 wt%) of the total molecular weight of the at least one block copolymer;
b) at least one diacid; and
c) at least one short chain diol, wherein the molecular weight of the short chain diol is < 250 g/mol.

16. The co-polyester composition of claim 15, wherein

the block polymer is between about 90 wt% and about 25 wt% of the co-polyester composition;

the short chain diol is less than 25 wt% of the co-polyester composition;

the diacid is terephthalic acid; and/or

the short chain diol is 1,4-butane diol.