

Claims

1. A resin composition comprising at least one first monomeric or oligomeric component (A), at least one second monomeric or oligomeric component (B) and a photoinitiator,
wherein
the first monomeric or oligomeric component (A) has a formula $[(A_1)-(A_2)_b]_a-[(A_3)]_e$,
wherein
 A_1 is independently selected from an acrylate moiety or a methacrylate moiety,
 A_2 is independently selected from the group consisting of a linear alkyl, a linear alkoxy ether and a linear poly(alkoxy ether) moiety, said linear alkyl, said linear alkoxy ether or said linear poly(alkoxy ether) moiety being optionally substituted by at least one hydroxyl substituent,
 a is an integer selected from at least 2,
 b is an integer selected from 0 or at least 1,
 e is an integer selected from at least 1, and
 if a is 2, A_3 is selected from the group consisting of an aryl, a biaryl, a tricyclic alkyl and a urethane moiety, or
 if a is 3 or more, A_3 is selected from the group consisting of an alkoxy ether, a saturated heterocycle or an alkyl moiety,
and the second monomeric or oligomeric component (B) has a formula $(B_1)_c-(B_2)_d$,
wherein
 B_1 is independently selected from an acrylate moiety or a methacrylate moiety,
 B_2 is independently selected from the group consisting of an alkyl, an alkoxy ether, a thioalkyl, an aryl, an amino and a poly(alkoxy ether) moiety,
 c is an integer selected from 1 or 2, and
 d is an integer selected from at least 1.
2. The resin composition of claim 1, wherein the first monomeric or oligomeric component (A) has a percentage composition by weight in the range of 10 wt% to 80 wt%, based on the weight of the resin composition.
3. The resin composition of claim 1, wherein the second monomeric or oligomeric component (B) has a percentage composition by weight in the range of 20 wt% to 80 wt%, based on the weight of the resin composition.
4. The resin composition of claim 1, wherein the photoinitiator has a percentage composition by weight in the range of 0.1 wt% to 10 wt%, based on the weight of the resin composition.
5. The resin composition of claim 1, wherein the first monomeric or oligomeric component (A) and the second monomeric or oligomeric component (B) each have an average molar mass of between 100 to 1200 g/mol.
6. The resin composition of claim 1, wherein the first monomeric or oligomeric component (A) is selected from the group consisting of bisphenol A dimethacrylate

(bis-DMA), bisphenol A diglycidyl ether methacrylate (bis-GMA), ethoxylated bisphenol-A dimethacrylate (bis-EMA), tricyclo[5.2.1.0^{2,6}]decanedimethanol diacrylate, bisphenol A glycerolate diacrylate, bisphenol A ethoxylate diacrylate, bisphenol A ethoxylate dimethacrylate (oligomer), bisphenol F ethoxylate diacrylate (oligomer), hydroquinone diacrylate, naphthalene-1,5- diyl diacrylate, tricyclodecane dimethanol diacrylate, urethane acrylate (oligomer), branched hexa-functional aliphatic urethane acrylate, di(trimethylolpropane) tetraacrylate, pentaerythritol triacrylate, 1,3,5-triacryloylhexahydro-1,3,5-triazine, trimethylolpropane propoxylate triacrylate, trimethylolpropane triacrylate and trimethylolpropane trimethacrylate.

7. The resin composition of claim 1, wherein the first monomeric or oligomeric component (A) is bisphenol A dimethacrylate.
8. The resin composition of claim 1, wherein the second monomeric or oligomeric component (B), wherein d is 1, is selected from the group consisting of ethyl acrylate, butyl acrylate, tert-butyl acrylate, ethyl 2-ethylacrylate, 2-(diethylamino)ethyl acrylate, 3-(dimethylamino)propyl acrylate, 2-carboxyethyl acrylate, 2-carboxyethyl acrylate oligomers, ethylene glycol methyl ether acrylate, ethyl 2-propylacrylate, hexyl acrylate, 4-hydroxybutyl acrylate, 2-hydroxyethyl acrylate, isodecyl acrylate, isooctyl acrylate, lauryl acrylate, methyl acrylate, methyl 3-hydroxy-2-methylenebutyrate, octadecyl acrylate, pentafluorophenyl acrylate, poly(propylene glycol) acrylate, tetrahydrofurfuryl acrylate, 2-tetrahydropyranyl acrylate, tert-butyl methacrylate, cyclohexyl methacrylate, 3,3'-diethoxypropyl methacrylate, 2-(diethylamino)ethyl methacrylate, di(ethylene glycol) methyl ether methacrylate, 2-ethoxyethyl methacrylate, ethylene glycol dicyclopentenyl ether methacrylate, ethylene glycol methyl ether methacrylate, 2-ethylhexyl methacrylate, ethyl methacrylate, furfuryl methacrylate, glycidyl methacrylate, hexyl methacrylate, 2-hydroxyethyl methacrylate, 2-isocyanatoethyl methacrylate, isodecyl methacrylate, lauryl methacrylate, methyl methacrylate, phenyl methacrylate, poly(propylene glycol) methacrylate, propyl methacrylate and tetrahydrofurfuryl methacrylate.
9. The resin composition of claim 1, wherein the second monomeric or oligomeric component (B), wherein d is 2, is selected from the group consisting of diethylene glycol diacrylate, polyethylene glycol diacrylate, 1,4-butanediol diacrylate, tripropylene glycol diacrylate, 1,3-butanediol diacrylate, 1,6-hexanediol diacrylate, tetraethylene glycol diacrylate, neopentyl glycol diacrylate, dipropylene glycol diacrylate, thiol diethylene glycol diacrylate, ethylene glycol dimethacrylate, poly(ethylene glycol) dimethacrylate, tetraethyleneglycol dimethacrylate, tetraethylene glycol dimethacrylate and poly(propylene glycol) dimethacrylate.
10. The resin composition of claim 1, wherein the second monomeric or oligomeric component (B) is di(ethylene glycol) methyl ether methacrylate.
11. The resin composition of claim 1, wherein the photoinitiator is selected from the group consisting of bis(2,4, 6-trimethyl benzoyl)phenylphosphine oxide (IRGACURE 819), 2,4,6-trimethylbenzoyl diphenyl phosphine (TPO), 2-hydroxy-2-methyl-1-phenyl-1-propane (DAROCUR 1173) and benzophenone (BP).

12. The resin composition of claim 1, wherein the resin composition has a viscosity of between 1 to 3000 cps.
13. A method of preparing a polymer from the resin composition of any one of claims 1 to 12 comprising the steps of (i) polymerizing the resin composition of any one of claims 1 to 12 with light, and (ii) curing the polymer from step (i) with ultraviolet radiation.
14. The method of claim 13, wherein the polymerizing step (i) is undertaken at a temperature in the range of about 20°C to about 30°C.
15. A polymer blend obtainable by the method of claim 13 or 14, wherein the polymer blend comprises a first polymer, resulting from polymerization of the first monomeric or oligomeric component (A) of the resin composition of any one of claims 1 to 11, and a second polymer, resulting from polymerization of the second monomeric or oligomeric component (B) of the resin composition of any one of claims 1 to 11, interpenetrated with the first polymer.
16. The polymer of claim 15, wherein the polymer exhibits a Young's modulus of between 1.5 GPa to 5.0 GPa.
17. The polymer of claim 15, wherein the polymer exhibits a flexure strength of between 40 MPa to 150 MPa.
18. A method of forming a 3-dimensional printed article, comprising the steps of (i) polymerizing a resin composition of any one of claims 1 to 12 with light using a 3-dimensional printer, and (ii) curing the polymer from step (i) with ultraviolet radiation.
19. A kit comprising:
 - (i) at least one first monomeric or oligomeric component (A),
 - (ii) at least one second monomeric or oligomeric component (B), and
 - (iii) a photoinitiator.