CLAIMS

1. A polyolefin composite comprising

a matrix comprising a polyolefin, a polymer having a moiety grafted thereon, and a polymerisable epoxide linker, wherein the moiety grafted on the polymer is covalently bonded to the polymerisable epoxide linker via a chemical bond, wherein the polymerisable epoxide linker is derived from a polymerisable epoxide resin obtained by a reaction between an amine and an epoxide-containing precursor, wherein the amine is selected from the group consisting of tetraglycidyldiaminodiphenylmethane, aminophenol, aminocresol, xylenediamine, and a combination thereof, and

a filler disposed within the matrix.

2. The polyolefin composite of claim 1, wherein the polyolefin is selected from the group consisting of a polymer or a random copolymer or a block copolymer of a C_{2-20}alkylene, a C_{4-20}alkyldiene, a C_{6-20}alkyltriene, a C_{3-20}cycloalkylene, a C_{4-20}cycloalkyldiene, a C_{5-20}cycloalkyltriene, a C_{8-20}phenylalkylene, and a combination thereof, optionally from a polymer or a random copolymer or a block copolymer of ethylene, propylene, 1-pentene, 1-butene, 4-methyl-1-pentene, 1-hexene, 1-octene, 1-decene, styrene, ethylidene norbornene, 1,4-hexadiene, 1,5-hexadiene, 1,7-octadiene, 1,9-decadiene, dicyclopentadiene and ethylene-propylene-diene monomer.

3. The polyolefin composite of claim 1 or 2, wherein the polyolefin is polyethylene.

4. The polyolefin composite of claim 1 or 2, wherein the polyolefin is polypropylene, optionally in a combination with an ethylene-α-olefin copolymer.

5. The polyolefin composite of any one of the preceding claims, wherein the polyolefin has a melt flow rate of 5 g/10 min to 100 g/10 min, optionally of 5 g/10 min to 50 g/10 min at a temperature of 230 °C and at a weight of 2.16 kg.

6. The polyolefin composite of any one of the preceding claims, wherein the polyolefin is present in a weight percentage range of 30wt% to 95wt%, or of 40wt% to 95wt%, or of

50wt% to 95wt%, or of 50wt% to 90wt%, or of 50wt% to 80wt%, or of 50wt% to 70wt%, based on the total weight of the polyolefin composite.

7. The polyolefin composite of any one of the preceding claims, wherein the polymer having a moiety grafted thereon is a further polyolefin having a moiety grafted thereon.

8. The polyolefin composite of claim 7, wherein the further polyolefin is selected from the group consisting of a polymer or a random copolymer or a block copolymer of a C_{2-20}alkylene, a C_{4-20}alkyldiene, a C_{6-20}alkyltriene, a C_{3-20}cycloalkylene, a C_{4-20}cycloalkyldiene, a C_{5-20}cycloalkyltriene, a C_{8-20}phenylalkylene, and a combination thereof, optionally from a polymer or a random copolymer or a block copolymer of ethylene, propylene, 1-pentene, 1-butene, 4-methyl-1-pentene, 1-hexene, 1-octene, 1-decene, styrene, ethylidene norbornene, 1,4-hexadiene, 1,5-hexadiene, 1,7-octadiene, 1,9-decadiene, dicyclopentadiene and ethylene-propylene-diene monomer.

9. The polyolefin composite of claim 7 or 8, wherein the further polyolefin is polypropylene.

10. The polyolefin composite of any one of the preceding claims, wherein the polymer having a moiety grafted thereon is present in a weight percentage range of up to 50wt%, or between 0.1wt% and 50wt%, or between 0.001wt% and 30wt%, or between 0.1wt% and 40wt%, or between 0.1wt% and 20wt%, or of 5wt%, or of 10wt%, based on the total weight of the polyolefin composite.

11. The polyolefin composite of any one of the preceding claims, wherein the polymer having a moiety grafted thereon is present in a weight percentage range of up to 10wt%, or between 0.1wt% and 10wt%, or between 4wt% and 10wt%, based on the total weight of the polyolefin composite.

12. The polyolefin composite of any one of the preceding claims, wherein the moiety grafted on the polymer comprises a –COO- group which forms the chemical bond with the polymerizable epoxide linker.

13. The polyolefin composite of claim 12, wherein the moiety comprising the –COO- group of the polymer is derived from an anhydride selected from the group consisting of maleic anhydride, succinic anhydride, citraconic anhydride, endo-bi-cyclo[2,2,1]-1,4,5,6,7,7-hexa-chloro-5 heptene-2,3-dicarboxylic acid anhydride, endo-bi-cyclo[2,2,1]-5-heptene-2,3-dicarboxylic acid anhydride, cis-4-cyclohexene-1,2-dicarboxylic acid anhydride, and a combination thereof.

14. The polyolefin composite of claim 12 or 13, wherein the moiety comprising the –COO- group of the polymer is derived from maleic anhydride.

15. The polyolefin composite of any one of the preceding claims, wherein the polymer further comprises a functional group selected from the group consisting of a hydroxyl, a carboxylic acid, a carboxylate, methyl acrylate, methyl methacrylate, ethyl acrylate, ethyl methacrylate, butyl acrylate, butyl methacrylate, maleate monoester, maleate diester, and a combination thereof.

16. The polyolefin composite of any one of the preceding claims, wherein the polymerisable epoxide linker is present in a weight percentage range of up to 50wt%, or between 0.1wt% and 50wt%, or of up to 10wt%, or between 0.1wt% and 10wt%, or between 3wt% and 15wt%, based on the total weight of the polyolefin composite.

17. The polyolefin composite of any one of the claims 1 to 16, wherein the epoxide-containing precursor is selected from the group consisting of epichlorohydrin, ethylene oxide, propylene oxide, styrene oxide, cyclohexene oxide, phenyl glycidyl ether, and a combination thereof.

18. The polyolefin composite of any one of claims 1 to 17, wherein the polymerisable epoxide resin comprises a spiro ring.

19. The polyolefin composite of any one of the preceding claims, wherein the chemical bond is an ester bond.

20. The polyolefin composite of any one of the preceding claims, wherein the filler is present in a weight percentage range of 1wt% to 70wt%, optionally of 5wt% to 30wt%, optionally of 10wt% to 30wt%, optionally of 10wt% to 50wt%, optionally of 10wt% to 20wt% based on the total weight of the polyolefin composite.

21. The polyolefin composite of any one of the preceding claims, wherein the filler has a size of 0.1 μm to 50 mm.

22. The polyolefin composite of any one of the preceding claims, wherein a material of the filler is selected from the group consisting of clay, glass, carbon, cellulose, and a combination thereof.

23. The polyolefin composite of claim 22, wherein the material of the filler is glass and is present as glass roving, glass chopped strand, glass milled fiber, or a combination thereof.

24. The polyolefin composite of claim 22 or 23, wherein the material of the filler is glass and is surface-treated with an organosilane, thereby enabling hydrogen bonding and/or a covalent bond between the filler and the polymerisable epoxide linker.

25. The polyolefin composite of claim 24, wherein the organosilane comprises an active functional group selected from the group consisting of octyl, amine, vinyl, hydroxyl, thiol, and a combination thereof.

26. The polyolefin composite of claim 24 or 25, wherein the organosilane is selected from the group consisting of aminopropyltrimethoxysilane, γ-aminopropylmethyldimethoxysilane, γ-aminopropyltriethoxysilane, γ-aminopropylmethyldiethoxysilane, γ-(N,N-dimethyl)aminopropyltrimethoxysilane, γ-(N,N-diethyl)aminopropyltrimethoxysilane, γ-(N,N-dibutyl)aminopropyltrimethoxysilane, γ-(N,N-dimethyl)aminopropyltriethoxysilane, γ-(N,N-diethyl)aminopropyltriethoxysilane, γ-(N,N-dibutyl)aminopropyltriethoxysilane, γ-(N-methyl)aminopropyltriethoxysilane, γ-(N-ethyl)aminopropyltriethoxysilane, γ-(N,N-dimethyl)aminopropylmethyldimethoxysilane, γ-(N,N-

diethyl)aminopropylmethyldimethoxysilane, γ-(N,N-dibutyl)aminopropylmethyldimethoxysilane, γ-(N-methyl)aminopropylmethyldimethoxysilane, and a combination thereof.

27. The polyolefin composite of any one of the claims 24 to 26, wherein the organosilane is present in a weight percentage range of 0.1wt% to 5wt%, based on the weight of the filler.

28. The polyolefin composite of claim 22, wherein the material of the filler is clay and is selected from the group consisting of inorganic silicate, alumino silicate, pellet-like metal oxide and hydroxide, anionic and cationic layered metal oxide and hydroxide, montmorillonite (MMT), kaolinite, dickite, halloysite, and nacrite, nontronite, beidellite, saponite, illite, biotite, lepidolite, phlogopite, clintonite, sepiolite, zinnwaldite, phengite, mica, layered metal oxide, layered metal hydroxide, attapulgite (AT), and a combination thereof.

29. The polyolefin composite of claim 28, wherein the inorganic silicate is calcium silicate.

30. The polyolefin composite of claim 28 or 29, wherein the clay comprises layered and/or pellet-like metal oxide.

31. The polyolefin composite of claim 30, wherein the layered and/or pellet-like metal oxide is selected from the group consisting of SiO_2, TiO_2, ZnO, CaO, Al_2O_3, Fe_2O_3, and a combination thereof.

32. The polyolefin composite of any one of the preceding claims, further comprising a stabilizer selected from the group consisting of an antioxidant, an ultraviolet ray absorber, and a combination thereof.

33. The polyolefin composite of claim 32, wherein the stabilizer is selected from the group consisting of a hindered phenol, a phosphite, a thioether, a benzophenone, a benzotriazole, and a combination thereof.

34. The polyolefin composite of claim 32, wherein the antioxidant is present in a weight percentage range of 0.01wt% to 1.0wt% based on the total weight of the polyolefin composite.

35. The polyolefin composite of any one of the preceding claims, further comprising additives selected from the group consisting of a slipping agent, an antistatic agent, a pigment, and a combination thereof.

36. The polyolefin composite of any one of the preceding claims, further comprising a styrene-based polymer.

37. The polyolefin composite of claim 36, wherein the styrene-based polymer is selected from the group consisting of polystyrene and styrene-acrylonitrile resin, and a combination thereof.

38. A method of providing a polyolefin composite, comprising a matrix comprising a polyolefin, a polymer having a moiety grafted thereon, and a polymerisable epoxide linker, wherein the polymerisable epoxide linker is derived from a polymerisable epoxide resin obtained by a reaction between an amine and an epoxide-containing precursor, wherein the amine is selected from the group consisting of tetraglycidyldiaminodiphenylmethane, aminophenol, aminocresol, xylenediamine, and a combination thereof, wherein the moiety grafted on the polymer is covalently bonded to the polymerisable epoxide linker via a chemical bond, and a filler disposed within the matrix,
the method comprising
(i) mixing a polyolefin, a polymer having a moiety grafted thereon, a polymerisable epoxide resin obtained by a reaction between an amine and an epoxide-containing precursor, wherein the amine is selected from the group consisting of tetraglycidyldiaminodiphenylmethane, aminophenol, aminocresol, xylenediamine, and a combination thereof, and a filler;
(ii) melting the mixture of step (i); and
(iii) kneading the mixture of step (ii).

39. The method of claim 38, wherein mixing the polyolefin, the polymer having a moiety grafted thereon, the polymerisable epoxide resin and the filler is carried out in a mixer or a drum tumbler.

40. The method of claim 38 or 39, wherein melting the mixture of step (i) comprises formation of the chemical bond between the moiety grafted on the polymer and the polymerisable epoxide linker, optionally at a temperature of 120 °C to 250 °C, or optionally at a temperature of 120 °C to 190 °C, or optionally at a temperature of 190 °C to 250 °C.

41. The method of any one of claims 38 to 40, wherein melting the mixture of step (i) comprises formation of an ester bond between the moiety grafted on the polymer and the polymerisable epoxide linker.

42. The method of any one of claims 38 to 41, wherein melting and kneading comprises physically agitating the mixture in a mixer, at least one roller, a twin extruder, or a combination thereof.

43. Use of a polyolefin composite of any one of claims 1 to 37 in transportation, infrastructure, consumer goods, and/or construction.

44. The use of claim 43, wherein the transportation is selected from the group consisting of aerospace, automotive, train, and a combination thereof.

45. The use of claim 43, wherein the infrastructure is selected from the group consisting of pipe, tank, and a combination thereof.

46. The use of claim 43, wherein the consumer goods are selected from the group consisting of packaging, sporting goods, electronics, and a combination thereof.